APPENDIX B

FIELD SUMMARY REPORT
REMEDIAL INVESTIGATION FIELD SAMPLING ACTIVITIES

FIELD SUMMARY REPORT
REMEDIAL INVESTIGATION SAMPLING ACTIVITIES
IR SITE 2, WEST BEACH LANDFILL AND WETLANDS
ALAMEDA POINT, CALIFORNIA

Contract No. N68711-01-D-6009
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Prepared for:

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The vendors and products, including the equipment, system components, and other materials identified in this report, are primarily for information purposes only. Although Battelle may have used some of these vendors and products in the past, mention in this report does not constitute Battelle's recommendation for using these vendors or products.

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1.0: INTRODUCTION

1.1 Objectives of Field Program

The purpose of this Field Summary Report is to describe the investigative scope of work that was implemented at Installation Restoration (IR) Site 2, West Beach Landfill and Wetland at the former Naval Air Station (NAS) Alameda Point in Alameda, CA to address data gaps from previous investigations and to generate a repository of site-specific and reference/background data that can be used to support the Remedial Investigation (RI) for the site. In general, data were generated from areas within the footprint of the landfill and within the inundated and non-inundated portions of the wetlands, and from suitable reference/background locations (i.e., locations with characteristics similar to the site but not affected by site activities or contamination) both at Alameda Point and at a suitable site located outside the boundaries of Alameda Point. Data were acquired during two seasonal sampling events, October 11-27, 2004 and March 7-20, 2005, to address potential seasonal variability in some environmental media (e.g., surface water in the wetland ponds), to allow minor data gaps from the first seasonal sampling event to be filled, and to allow appropriate planning for certain events (e.g., tissue sampling) to be fully developed.

Specific sampling procedures, protocols, and specific analytical methodologies related to the phases of investigation presented in this report have previously been described in greater detail in the Sampling and Analysis Plan (SAP), which was included as Appendix A of the Final RI Sampling Work Plan (Battelle et al., 2005). The field sampling plan described was developed to appropriately characterize portions of the site that had not been adequately addressed prior to this RI. Specific sampling locations were selected to provide reasonable and appropriate spatial coverage of the site and to address specific areas that were considered potential specific waste disposal areas, or on the basis of data reviewed following execution of the first seasonal sampling effort in October 2004. The analytical targets evaluated at each sampling location were selected to provide necessary data given the reported site history, the nature and results of historical sampling activities, the project data quality objectives (DQOs), data from the first seasonal sampling effort, and certain specific regulatory requirements.

Specifically, preliminary data acquisition activities in the form of geophysical and radiological surveying were performed prior to the onset of field sampling activities. Continuous surface water monitoring in the North and South Ponds was conducted for approximately eight months, starting in July 2004 and ending in March 2005. In October 2004, soil and groundwater sampling was performed in the landfill, and soil, groundwater, surface water and sediment sampling was performed in inundated and non-inundated portions of the wetlands. In March 2005, exploratory trenching was conducted along with some additional soil and groundwater sampling in the landfill. Sediment and surface water sampling was also performed in the wetland areas in March, at which time coincident samples were collected for bioaccumulation and toxicity testing. Plant tissue was collected from the landfill and wetland areas and attempts were made to collect fish, small mammal, and (terrestrial and benthic) invertebrate tissue samples in March 2005. This report will provide a more detailed discussion of all activities included in the investigative scope of this RI and deviations from the Final RI Sampling Work Plan (Battelle et al., 2005) that were necessary during field sampling activities.

1.2 General Location and Site Description

Refer to Section 2.0 of the Draft RI Report for a detailed summary of the site background and setting.

Alameda Point is located on the western end of Alameda Island, which lies on the eastern side of San Francisco Bay, adjacent to the City of Oakland. The locations of Alameda Point and IR Site 2 are depicted on Figure B-1. Overall, Alameda Point encompasses roughly 1,700 acres of land. Development

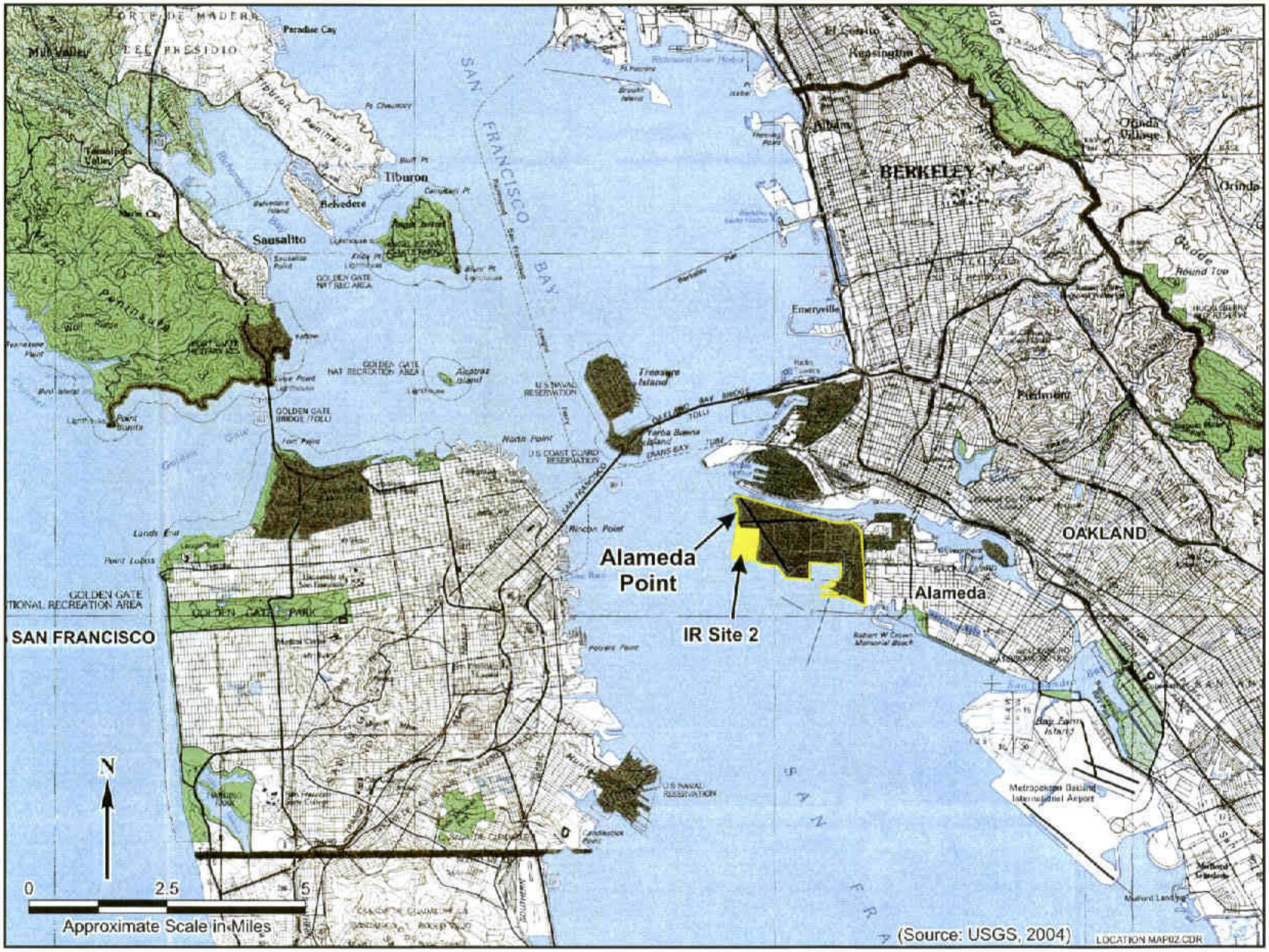


Figure B-1. Location Map of Alameda Point and IR Site 2 of Alameda Point first began in 1930 under the ownership of the United States Army, and the majority of the former NAS was built on shallow open water through dredging and filling. The average elevation of Alameda Point is only 15 ft above mean sea level (amsl).

Alameda Point served as a base of operations for Naval surface craft from prior to World War II until its closure in 1997. Closure of Alameda Point was mandated by the Defense Base Realignment and Closure Act (BRAC) of 1990. During its long history of operations, Alameda Point was home to several thousand military and civilian personnel, and supported operations of the Navy, Marine Corps, and other military entities. Hundreds of buildings and an extensive network of roadways and utilities were constructed at Alameda Point, and much of this infrastructure still exists. Alameda Point supported aviation activities through extensive runway and tarmac infrastructure and an enclosed lagoon for seaplanes, and also supported naval surface vessels (including aircraft carriers) through an extensive system of piers, berthing areas, and turning basins. Specific activities conducted historically at Alameda Point included, but are not limited to, aircraft maintenance, ship maintenance, support and training for Naval and Marine air units, storage, rework, and distribution of weaponry, fuel storage and refueling, dry goods storage and distribution, pest control, plating, metal working and fabrication, parts washing, cleaning and routine maintenance, blasting and painting, testing of jet engines, heavy equipment maintenance, woodworking, photography, and radiological operations that included the painting of aircraft dials with radioluminescent paints.

IR Site 2 is located on the southwestern corner of Alameda Point. The general layout of IR Site 2 is shown on Figure B-2. The site consists of the West Beach Landfill (herein also referred to simply as the landfill), which occupies approximately 77 acres, and the West Beach Wetlands (herein also referred to simply as the wetlands), which covers approximately 33 acres immediately south and west of the landfill. The site is bounded to the south and west by San Francisco Bay, along an area of the site that is referred to as the coastal margin, and to the east and north by runways, tarmacs, and related features, along an area of the site referred to as the interior margin (see Figure B-2). The landfill was reportedly used for disposal of waste generated by NAS activities from 1956 through early 1978. Please refer to Section 2.0 of the Draft RI Report for a more detailed summary of the site background and setting.

1.3 Organization of the Field Summary Report

This Field Summary Report is organized as follows:

Section 1.0: Introduction. Presents the specific objectives of this Field Summary Report, the general approach of the field sampling program, and a brief summary of the site history and setting.

Section 2.0: Preliminary Activities. Describes water quality monitoring, geophysical surveying and the preparation/mobilization that was done prior to the field sampling activities.

Section 3.0: Landfill Dry Season Sampling. Details environmental sampling that was performed in the landfill area of IR Site 2 in October 2004.

Section 4.0: Wetland/Wetland Ponds Dry Season Sampling. Details environmental sampling that was performed in the West Beach Wetland and wetland ponds of IR Site 2 in October 2004.

Section 5.0: Landfill Wet Season Sampling. Details environmental sampling that was performed in the landfill area of IR Site 2 in March 2005.

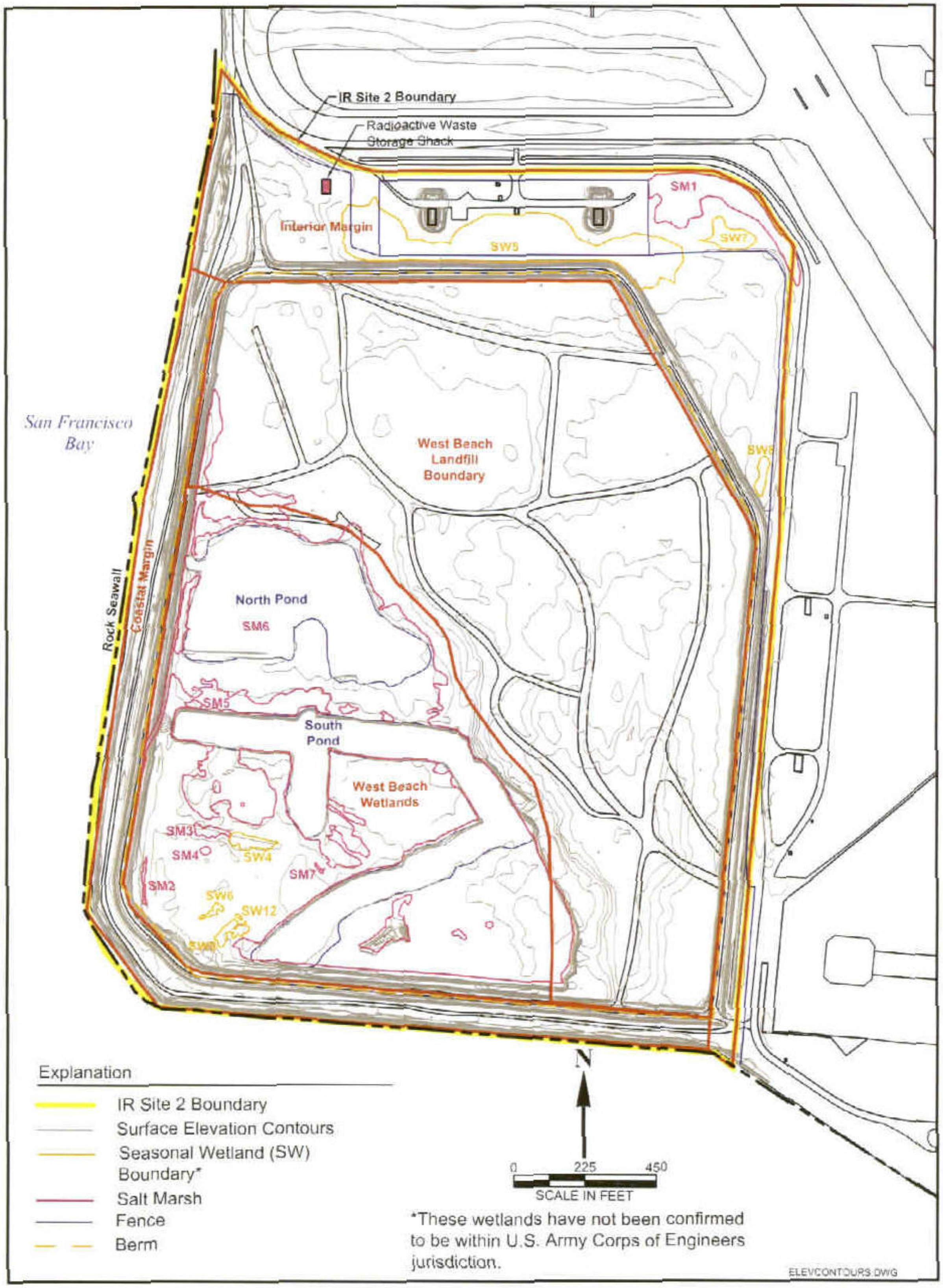


Figure B-2. Site Map of IR Site 2

Section 6.0: Wetland/Wetland Ponds Wet Season Sampling. Details environmental sampling that was performed in the wetland area and wetland ponds of IR Site 2 in March 2005.

Section 7.0: Reference/Background Sampling at Alameda Point and China Camp State Park. Details environmental sampling that was performed at Alameda Point and China Camp State Park (CCSP) to establish background data sets that can be utilized in the IR Site 2 RI.

Section 8.0: Summary of Problems and Deviations. Summarizes problems that were encountered during RI field sampling activities at IR Site 2 and deviations from the Final RI Sampling Work Plan (Battelle et al., 2005) that were required during the sampling activities.

Section 9.0: References.

Attachment 1: Plate Diagram of Final Geophysical Surveying Results

Attachment 2: Final Geophysical Surveying Report Issued by Power Surveying

Attachment 3: RI Field Sampling Photographs

Attachment 4: Field Sampling Log Sheets and Boring Logs

Attachment 5: Waste Manifests

Attachment 6: Memoranda Summarizing RI Tissue Sampling Efforts

Attachment 7: Memorandum Summarizing Reference Sampling at China Camp State Park

2.0: PRELIMINARY ACTIVITIES

Prior to conducting field sampling activities at IR Site 2, preliminary data acquisition activities in the form of pond water quality surveying and geophysical surveying were performed. Water quality measurements were taken over a period of approximately 8 months using dedicated meters deployed in the wetland ponds to track seasonal trends of several water quality parameters. A geophysical survey was performed in an attempt to locate potential buried waste at IR Site 2 and to align the proposed sampling locations in and around those areas of potential contamination. Mobilization of field equipment and supplies to a central staging area located north of IR Site 2 was also performed prior to field sampling activities. The following subsections describe these preliminary activities in a greater level of detail.

2.1 Water Quality Survey

The primary objective of the water quality survey was to continuously measure the physical properties of surface water in the North and South Ponds over a dry and wet seasonal cycle. Three YSI Model 6600-EDS-M(S) water quality data loggers (sondes) capable of recording depth, dissolved oxygen, conductivity, salinity, temperature, and turbidity were deployed on July 21, 2004 and removed on March 10, 2005. Originally the Navy planned to deploy four sondes to the ponds, two in the North Pond and two in the South Pond. However, only three sondes were deployed on July 21, 2004 (WQM01 in the western portion of the North Pond and WQM03 and WQM04 in the eastern and southern portions of the South Pond, respectively) because the water depth in the North Pond was extremely shallow in July 2004. A second meter (WQM02), and fourth overall, was deployed in the eastern portion of the North Pond on January 26, 2005 when the water depth had increased from rainfall. Prior to the initial deployment and during four servicing/calibration events, meters were removed from the ponds, cleaned, and calibrated according to manufacturer specifications. The water quality meter deployment locations are shown on Figure B-3. The monitoring locations were surveyed using a Trimble Geoexplorer® GeoXT™ hand-held GPS unit. North American Datum of 1927 (NAD27) coordinates for the four locations in and meter depth placement are provided in Table B-1.

Two mooring systems were constructed to accommodate the generally shallow water in the wetland ponds. One system, which was used in the southern portion of the South Pond (WQM04), consisted of acrylonitrile butadiene styrene (ABS) pipe with a pointed and sealed bottom that was driven into the mud (see Figure B-4). The mooring maintained the meter upside down in an upright position with the sensors located just above the sediment water interface. Due to stiff clay and very shallow water depths in the North Pond and the eastern portion of the South Pond, the ABS mooring could not be inserted deeply enough in the other two locations where meters were deployed in July 2004 (i.e., WQM01 and WQM03). A second mooring system was designed on-site consisting of weighted plastic buckets with the meter deployed in a horizontal position through the bucket, also maintaining the sensors just above the sediment water interface (Figure B-5). The horizontal bucket system was also used at WQ02 starting in January 2005.

During each servicing and recalibration event, data were downloaded onto field computers and subsequently transferred to offsite data storage systems. Servicing was performed on August 11, September 30, and December 21, 2004; and January 26, 2005.

Figure B-3. IR Site 2 RI Water Quality Meter Locations

Table B-1. IR Site 2 Sample Locations and Analytical Information

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
Dry Season - Landfill Soil Samples																																				
SOC01	474363.155	1471498.982	0-1'	√	√	√		√	√	√	√				√			√			√	√	√	√	√	√	√	√	√							
			3-4'	√	√	√		√	√													√	√	√	√	√	√	√	√							
			5-6'	√	√	√		√	√	√	√											√	√	√	√	√	√	√	√							
SOC02	474306.682	1471580.236	0-1'	√	√	√		√	√													√	√	√	√	√	√	√	√							
			3-4'	√	√	√		√	√	√	√				√			√			√	√	√	√	√	√	√	√	√							
			5-6'	√	√	√		√	√													√	√	√	√	√	√	√	√							
SOC03	474168.696	1471798.997	0-1'	√	√	√		√	√	√				√																						
			3-4'	√	√	√		√	√					√																						
			7-8'	√	√	√		√	√	√	√			√	√			√			√															
SOC04	474161.203	1472413.489	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√																									
			7-8'	√	√	√		√	√																											
SOC05	474164.147	1472762.373	0-1'	√	√	√		√	√	√	√				√			√			√															
			3-4'	√	√	√		√	√																											
			7-8'	√	√	√		√	√	√	√																									
SOC06	474056.778	1472648.126	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√				√			√			√															
			7-8'	√	√	√		√	√																											
SOC07	473861.078	1472680.891	0-1'	√	√	√		√	√	√	√																									
			3-4'	√	√	√		√	√		√																									
			7-8'	√	√	√		√	√	√	√				√			√			√															
SOC08	473763.1	1472897.339	0-1'	√	√	√		√	√					√																						
			3-4'	√	√	√		√	√	√	√																									
			5-6'	√	√	√		√	√					√																						
SOC09	473524.735	1472818.852	0-1'	√	√	√		√	√	√	√				√			√			√															
			3-4'	√	√	√		√	√																											
			7-8'	√	√	√		√	√	√	√																									
SOC10	473889.34	1471378.8	0-1'	√	√	√		√	√																											
			4-5'	√	√	√		√	√	√	√				√			√			√															
			Not attainable																																	
SOC11	473932.32	1471903.376	0-1'	√	√	√		√	√	√	√		√	√																						
			3-4'	√	√	√		√	√				√																							
			6-7'	√	√	√		√	√	√	√		√	√	√			√			√															
SOC12	473872.805	1472139.656	0-1'	√	√	√		√	√																											
			5-6'	√	√	√		√	√	√	√																									
			7-8'	√	√	√		√	√					√																						
SOC13	473731.095	1472364.321	0-1'	√	√	√		√	√	√	√				√			√			√															
			5-6'	√	√	√		√	√		√																									
			7-8'	√	√	√		√	√	√	√																									
SOC14	473739.845	1471306.168	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√				√			√			√															
			Not attainable																																	
SOC15	473729.325	1471605.666	0-1'	√	√	√		√	√	√			√	√																						
			3-4'	√	√	√		√	√	√			√	√																						
			5-6'	√	√	√		√	√	√	√		√	√	√			√			√															
SOC16	473680.872	1471928.371	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√																									
			7-8'	√	√	√		√	√																											

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 2 of 8)

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
SOC17	473584.134	1471336.194	0-1'	√	√	√		√	√	√	√			√	√			√			√	√	√	√	√	√	√	√	√							
			4-5'	√	√	√		√	√	√	√			√								√	√	√	√	√	√	√	√							
			Not attainable																																	
SOC18	473490.325	1471657.027	0-1'	√	√	√		√	√				√																							
			3-4'	√	√	√		√	√	√	√		√		√			√			√															
			5-6'	√	√	√		√	√				√																							
SOC19	473509.257	1472099.101	0-1'	√	√	√		√	√	√	√			√								√	√	√	√	√	√	√	√							
			3-4'	√	√	√		√	√					√								√	√	√	√	√	√	√	√							
			7-8'	√	√	√		√	√	√	√			√	√			√			√	√	√	√	√	√	√	√	√							
SOC20	473536.962	1472410.593	0-1'	√	√	√		√	√					√																						
			3-4'	√	√	√		√	√	√	√			√																						
			7-8'	√	√	√		√	√					√																						
SOC21	473374.89	1471306.109	0-1'	√	√	√		√	√	√	√		√		√			√			√															
			2-3'	√	√	√		√	√				√																							
			Not attainable																																	
SOC22	473341.913	1471723.069	0-1'	√	√	√		√	√					√																						
			5-6'	√	√	√		√	√	√	√			√	√			√			√															
			Not attainable																																	
SOC23	473350.344	1472234.693	0-1'	√	√	√		√	√	√	√		√																							
			3-4'	√	√	√		√	√				√	√																						
			7-8'	√	√	√		√	√	√	√		√	√	√			√			√															
SOC24	473348.673	1472710.622	0-1'	√	√	√		√	√													√	√	√	√	√	√	√	√							
			3-4'	√	√	√		√	√	√	√			√								√	√	√	√	√	√	√	√							
			7-8'	√	√	√		√	√					√								√	√	√	√	√	√	√	√							√
SOC25	473190.027	1471962.925	0-1'	√	√	√		√	√	√	√				√			√			√															√
			3-4'	√	√	√		√	√																											√
			7-8'	√	√	√		√	√	√	√																									√
SOC26	473213.152	1472504.985	0-1'	√	√	√		√	√																											√
			3-4'	√	√	√		√	√	√	√				√			√			√															√
			7-8'	√	√	√		√	√																											√
SOC27	473084.666	1472391.348	0-1'	√	√	√		√	√	√	√											√	√	√	√	√	√	√	√							√
			3-4'	√	√	√		√	√													√	√	√	√	√	√	√	√							√
			7-8'	√	√	√		√	√	√	√				√			√			√	√	√	√	√	√	√	√	√							√
SOC28	473045.585	1472722.941	0-1'	√	√	√		√	√				√	√																						√
			3-4'	√	√	√		√	√		√		√	√																						√
			7-8'	√	√	√		√	√				√	√																						√
SOC29	473007.608	1471877.42	0-1'	√	√	√		√	√	√	√				√			√			√															√
			4-5'	√	√	√		√	√																											√
			7-8'	√	√	√		√	√	√	√		√																							√
SOC30	473005.955	1472211.7	0-1'	√	√	√		√	√		√			√																						
			3-4'	√	√	√		√	√	√	√			√	√			√			√															
			6-7'	√	√	√		√	√		√			√																						√
SOC31	472870.221	1472505.483	0-1'	√	√	√		√	√	√	√																									√
			3-4'	√	√	√		√	√																											√
			6-7'	√	√	√		√	√	√	√				√			√			√															√
SOC32	472677.844	1472100.094	0-1'	√	√	√		√	√				√	√																						√
			3-4'	√	√	√		√	√	√	√		√	√																						
			6-7'	√	√	√		√	√				√	√																						
SOC33	472682.085	1472437.198	0-1'	√	√	√		√	√	√	√				√			√			√															
			3-4'	√	√	√		√	√																											
			7-8'	√	√	√		√	√	√	√																									

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 3 of 8)

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
SOC34	472665.649	1472693.013	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√				√			√			√															
			7-8'	√	√	√		√	√																											
SOC35	472405.086	1472262.936	0-1'	√	√	√		√	√	√	√			√								√	√	√	√	√	√	√	√							
			3-4'	√	√	√		√	√					√								√	√	√	√	√	√	√	√							
			7-8'	√	√	√		√	√	√	√			√	√			√			√	√	√	√	√	√	√	√	√							
SOC36	472472.028	1472549.665	0-1'	√	√	√		√	√				√																							
			3-4'	√	√	√		√	√	√	√		√																							
			7-8'	√	√	√		√	√				√																							
SOC37	472216.456	1472537.815	0-1'	√	√	√		√	√	√	√				√			√			√															
			3-4'	√	√	√		√	√																											
			7-8'	√	√	√		√	√	√	√																									
SOC38	472174.742	1472331.873	0-1'	√	√	√		√	√			√																								
			2-3'	√	√	√		√	√	√	√	√			√			√			√															
			7-8'	√	√	√		√	√			√																								
SOC39	471972.184	1472456.497	0-1'	√	√	√		√	√	√	√	√										√	√	√	√	√	√	√	√							
			5-6'	√	√	√		√	√			√										√	√	√	√	√	√	√	√							
			7-8'	√	√	√		√	√	√	√	√			√			√			√	√	√	√	√	√	√	√	√							
SOC40	471932.34	1472664.715	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√																									
			5-6'	√	√	√		√	√																											
Dry Season - Wetland Soil Samples																																				
SOC41	473327.294	1471204.398	0-1'	√	√	√		√	√	√	√			√	√			√			√	√	√	√	√	√	√	√	√							
			Not attainable																																	
			Not attainable																																	
SOC42	473261.891	1471604.31	0-1'	√	√	√		√	√																											
			Not attainable																																	
			Not attainable																																	
SOC43	473046.817	1471718.921	0-1'	√	√	√		√	√	√	√																									
			3-4'	√	√	√		√	√	√	√																									
			Not attainable																																	
SOC44	472786.002	1471939.274	0-1'	√	√	√		√	√																											
			3-4'	√	√	√		√	√	√	√				√			√			√															
			6-7'	√	√	√		√	√																											
SOC45	472723.902	1471630.387	0-1'	√	√	√		√	√	√	√			√	√			√			√	√	√	√	√	√	√	√	√							
			2-3'	√	√	√		√	√					√	√			√			√	√	√	√	√	√	√	√	√							
			Not attainable																																	
SOC46	472781.044	1471260.011	0-1'	√	√	√		√	√																											
			2-3'	√	√	√		√	√	√	√		√		√			√			√															
			Not attainable																																	
SOC47	472348.928	1471095.485	0-1'	√	√	√		√	√	√	√																									
			1-2'	√	√	√		√	√						√			√			√															
			Not attainable																																	
SOC48	472065.802	1471139.358	0-1'	√	√	√		√	√					√								√	√	√	√	√	√	√	√							
			1-2'	√	√	√		√	√	√	√		√	√								√	√	√	√	√	√	√	√							
			Not attainable																																	
SOC49	472282.386	1471701.852	0-1'	√	√	√		√	√	√	√				√			√			√															
			2-3'	√	√	√		√	√				√																							
			Not attainable																																	

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 4 of 8)

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
SOC50	472482.515	1471826.129	0-1'	√	√	√		√	√				√	√								√	√	√	√	√	√	√	√							
			2-3'	√	√	√		√	√	√	√			√	√			√			√	√	√	√	√	√	√	√	√							
			4-5'	√	√	√		√	√					√								√	√	√	√	√	√	√	√							
SOC51	471932.358	1471118.669	0-1'	√	√	√		√	√	√	√																									
			1-2'	√	√	√		√	√	√	√		√																							
			Not attainable																																	
SOC52	471950.787	1471738.916	0-1'	√	√	√		√	√																											
			1-2'	√	√	√		√	√	√	√																									
			Not attainable																																	
SOC53	471902.005	1472052.791	0-1'	√	√	√		√	√	√	√		√		√			√			√															
			1-2'	√	√	√		√	√																											
			Not attainable																																	
SOC54	472114.623	1472040.564	0-1'	√	√	√		√	√																											
			1-2'	√	√	√		√	√	√	√				√			√			√															
			Not attainable																																	
SOC55	472506.449	1472139.913	0-1'	√	√	√		√	√	√	√																									
			3-4'	√	√	√		√	√				√																							
			11-12'	√	√	√		√	√	√	√		√		√			√			√															
Dry Season - Wetland Surface Soil Samples																																				
SOG01	473211.727	1471152.964	0-1'	√	√	√		√	√																											
SOG02	473313.346	1471364.266	0-1'	√	√	√		√	√	√	√																									
SOG03	473144.406	1471665.968	0-1'	√	√	√		√	√																											
SOG04	472935.136	1471876.254	0-1'	√	√	√		√	√	√	√		√		√			√			√															
SOG05	472730.137	1471843.165	0-1'	√	√	√		√	√																											
SOG06	472706.535	1471477.239	0-1'	√	√	√		√	√	√	√																									
SOG07	472888.237	1471471.378	0-1'	√	√	√		√	√																											
SOG08	472816.766	1471306.799	0-1'	√	√	√		√	√	√	√																									
SOG09	472767.916	1471098.067	0-1'	√	√	√		√	√																											
SOG10	472988.713	1471098.78	0-1'	√	√	√		√	√	√	√		√																							
SOG11	472507.972	1471044.28	0-1'	√	√	√		√	√																											
SOG12	472517.915	1471361.069	0-1'	√	√	√		√	√	√	√				√			√			√															
SOG13	472443.106	1471228.348	0-1'	√	√	√		√	√																											
SOG14	472267.943	1471193.387	0-1'	√	√	√		√	√	√	√		√																							
SOG15	472176.904	1471047.81	0-1'	√	√	√		√	√																											
SOG16	472196.81	1471363.077	0-1'	√	√	√		√	√	√	√				√			√			√															
SOG17	472057.259	1471345.884	0-1'	√	√	√		√	√																											
SOG18	472190.069	1471508.445	0-1'	√	√	√		√	√	√	√		√																							
SOG19	472333.09	1471631.34	0-1'	√	√	√		√	√																											
SOG20	472528.874	1471605.505	0-1'	√	√	√		√	√	√	√				√			√			√															
SOG21	472394.625	1471897.999	0-1'	√	√	√		√	√																											
SOG22	471905.51	1471575.159	0-1'	√	√	√		√	√	√	√		√																							
SOG23	472015.949	1471894.177	0-1'	√	√	√		√	√																											
SOG24	472023.208	1472053.12	0-1'	√	√	√		√	√	√	√				√			√			√															
SOG25	471866.669	1471900.506	0-1'	√	√	√		√	√																											
Dry Season - Groundwater Samples																																				
HYP01	474306.682	1471580.236	FWBZ	√	√		√	√	√	√	√											√	√	√	√	√	√	√	√	√	√				√	
HYP02	474056.778	1472648.126	FWBZ	√	√		√	√	√		√																			√	√				√	
HYP03	473861.078	1472680.891	FWBZ	√	√		√	√	√	√	√																			√	√				√	
HYP04	473889.34	1471378.8	FWBZ	√	√		√	√	√																					√	√				√	
HYP05	473932.32	1471903.376	FWBZ	√	√		√	√	√	√	√																			√	√				√	
HYP06	473731.095	1472364.321	FWBZ	√	√		√	√	√	√	√																			√	√				√	

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 5 of 8)

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
HYP07	473729.325	1471605.666	FWBZ	√	√		√	√	√		√																			√	√				√	
HYP08	473584.134	1471336.194	FWBZ	√	√		√	√	√																					√	√				√	
HYP09	473341.913	1471723.069	FWBZ	√	√		√	√	√	√	√											√	√	√	√	√	√	√	√	√	√				√	
HYP10	473348.673	1472710.622	FWBZ	√	√		√	√	√													√	√	√	√	√	√	√	√	√	√				√	
HYP11	472870.221	1472505.483	FWBZ	√	√		√	√	√													√	√	√	√	√	√	√	√	√	√				√	
HYP12	472467.665	1472543.623	FWBZ	√	√		√	√	√	√	√	√																		√	√				√	
HYP13	471932.34	1472664.715	FWBZ	√	√		√	√	√	√	√	√										√	√	√	√	√	√	√	√	√	√				√	
Dry Season - Landfill Groundwater Samples																																				
HYP14	473327.294	1471204.398	FWBZ	√	√		√	√	√	√	√											√	√	√	√	√	√	√	√	√	√				√	
HYP15	472742.114	1471268.228	FWBZ	√	√		√	√	√																					√	√				√	
HYP16	472786.002	1471939.274	FWBZ	√	√		√	√	√	√	√																			√	√				√	
HYP17	472348.928	1471095.485	FWBZ	√	√		√	√	√																					√	√				√	
HYP18	472482.515	1471826.129	FWBZ	√	√		√	√	√	√	√											√	√	√	√	√	√	√	√	√	√				√	
HYP19	471932.358	1471118.669	FWBZ	√	√		√	√	√																					√	√				√	
HYP20	471902.005	1472052.791	FWBZ	√	√		√	√	√	√	√	√																		√	√				√	
Dry Season - Wetland Surface Water Samples																																				
SWA01	473202.153	1471220.243	0-1m	√	√		√	√	√							√	√																			
SWA02	473085.65	1471419.917	0-1m	√	√		√	√	√							√	√																			
SWA03	473156.457	1471590.471	0-1m	√	√		√	√	√	√	√					√	√																			
SWA04	472969.165	1471306.257	0-1m	√	√		√	√	√	√	√					√	√					√	√	√	√	√	√	√	√							
SWA05	472996.223	1471655.872	0-1m	√	√		√	√	√							√	√																			
SWA06	472852.626	1471670.561	0-1m	√	√		√	√	√	√	√					√	√					√	√	√	√	√	√	√	√							
SWA07	Not attainable																																			
SWA08	Not attainable																																			
SWA09	472592.819	1471748.085	0-1m	√	√		√	√	√	√	√					√	√					√	√	√	√	√	√	√	√							
SWA10	472450.32	1472041.654	0-1m	√	√		√	√	√	√	√					√	√																			
SWA11	472138.334	1471784.397	0-1m	√	√		√	√	√							√	√																			
SWA12	472029.218	1471562.862	0-1m	√	√		√	√	√	√	√					√	√					√	√	√	√	√	√	√	√							
WQM01	473140.593	1471150.154	~20 cm																											√	√	√	√	√	√	
WQM02	1471626	473026	NA																											√	√	√	√	√	√	
WQM03	472467.797	1472033.041	~20 cm																											√	√	√	√	√	√	
WQM04	472109.947	1471708.097	~30 cm																											√	√	√	√	√	√	
Dry Season - Wetland Sediment Samples																																				
SDC01	473222.3876	1471145.025	0-0.3	√	√	√		√	√	√	√																									
			0.3-1.5	√	√	√		√	√																											
			1.5-3	√	√	√		√	√	√	√																									
SDC02	473174.3701	1471570.415	0-0.3	√	√	√		√	√																											
			0.3-1.5	√	√	√		√	√	√	√																									
			1.5-2.7	√	√	√		√	√																											
SDC03	472890.6978	1471717.77	0-0.3	√	√	√		√	√	√	√																									
			0.3-1.5	√	√	√		√	√																											
			1.5-2.7	√	√	√		√	√	√	√																									
SDC04	472520.9479	1471387.392	0-0.3	√	√	√		√	√																											
			0.3-1.3	√	√	√		√	√	√	√																									
			1.3-1.8	√	√	√		√	√																											
SDC05	472491.9261	1471996.418	0-0.3	√	√	√		√	√	√	√																									
			0.3-1.5	√	√	√		√	√																											
			1.5-2.8	√	√	√		√	√	√	√																									
SDC06	472143.0216	1471754.606	0-0.3	√	√	√		√	√																											
			0.3-1.5	√	√	√		√	√	√	√																									
			1.5-2.3	√	√	√		√	√																											

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 6 of 8)

				Chemical											Physicochemical							Radiological								General Quality						Tox
Station ID	Northing	Easting	Depth Interval	PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
Wet Season – Landfill Soil Samples																																				
SOC56	474444.424	1471437.066	0-1'	√		√			√															√	√											
			2-3'	√		√			√															√	√											
			Not attainable																																	
SOC57	473615.05	1472905.567	0-1'						√					√																						
			2-3'						√					√																						
			Not attainable																																	
SOC58	473638.757	1471392.971	0-1'			√			√					√																						
			2-3'			√			√					√																						
			6-7'			√			√					√																						
SOC59	473576.43	1472017.808	0-1'			√			√					√																						
			3-4'			√			√					√																						
			Not attainable																																	
SOC60	473662.	1472421.156	0-1'						√					√																						
			2-3'						√					√																						
			Not attainable																																	
SOC61	473545.406	1472596.808	0-1'						√					√										√	√											
			2-3'						√					√										√	√											
			4-5'						√					√										√	√											
SOC62	473339.582	1472516.373	0-1'						√					√										√	√											
			3-4'						√															√	√											
			Not attainable																																	
SOC63	473146.076	1472731.902	0-1'											√										√	√											
			2-3'											√										√	√											
			4-5'											√										√	√											
SOC64	473080.829	1472255.063	0-1'			√			√																											
			2-3'			√			√																											
			Not attainable																																	
SOC65	472857.329	1472737.517	0-1'											√																						
			2-3'											√																						
			Not attainable																																	
SOC66	472376.162	1472505.544	0-1'			√																		√	√											
			2-3'			√																		√	√											
			4-5'			√																		√	√											
Wet Season – Landfill Trench Sidewall Samples																																				
TRN01	473947.595	1472107.03	0-1'	√	√	√			√					√																						
			1-2'	√	√	√			√					√																						
TRN02	473489.507	1471393.825	0-1'	√	√	√			√																											
			1-2'	√	√	√			√																											
			1-2' DUP	√	√	√			√																											
TRN03	473431.991	1472134.607	0-1'		√	√			√					√																						
			1-3'		√	√			√					√																						
TRN04	473038.935	1472503.423	0-1'		√	√			√																											
			1-3'		√	√			√																											
			3-6'		√	√			√																											
TRN05	472355.718	1472326.306	0-1'	√	√	√																		√	√											
			1-3'	√	√	√																		√	√											
			3-5'	√	√	√																		√	√											
			5-8'	√	√	√																		√	√											

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 7 of 8)

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
Wet Season - Wetland Bioaccumulation Samples																																				
SOC42	473265.521	1471601.646	0-1'	√	√	√		√	√																											√
SOC48	472134.276	1471194.047	0-1'	√	√	√		√	√																											√
SOC50	472487.468	1471825.608	0-1'	√	√	√		√	√																											√
SOG11	472499.789	1471039.14	0-1'	√	√	√		√	√																											√
Wet Season - Alameda Reference Soil Samples																																				
SOCREF1-1	474584.257	1475510.94	0-1'											√																						
SOCREF1-4	474437.166	1475608.73	0-1'											√																						
SOCREF2-1	473818.019	1478508.76	0-1'											√																						
SOCREF2-4	473770.587	1478363.44	0-1'											√																						
SOCREF3-1	474207.84	1479507.61	0-1'											√																						
SOCREF3-3	474111.783	1479457.24	0-1'											√																						
Wet Season - China Camp Reference Soil Samples																																				
SOC117	555355.022	1427863.01	0-0.3'	√	√	√		√	√																											√
SOC118	554970.237	1428936.37	0-0.3'	√	√	√		√	√																											√
SOC120	554864.373	1429388.496	0-0.3'	√	√	√		√	√																											√
SOC122	555608.287	1427845.779	0-0.3'	√	√	√		√	√																											√
SOC123	555012.997	1428931.07	0-0.3'	√	√	√		√	√																											√
SOC125	554920.351	1429457.466	0-0.3'	√	√	√		√	√																											√
Wet Season - Landfill Groundwater Samples																																				
HYP21	472156.885	1472288.685	FWBZ	√	√		√	√	√			√										√	√	√	√	√	√	√	√	√	√	√	√	√	√	
HYP22	473638.227	1471393.502	FWBZ											√																√	√	√	√	√	√	
HYP23	473145.748	1472731.64	FWBZ											√																√	√	√	√	√	√	
Wet Season - Wetland Surface Water Samples																																				
SWA01	473203.364	1471222.431	0-1m	√	√	√	√	√	√							√	√		√											√	√	√	√	√	√	√
SWA02	473090.397	1471420.91	0-1m	√	√	√	√	√	√							√	√		√											√	√	√	√	√	√	√
SWA03	473157.873	1471591.947	0-1m	√	√	√	√	√	√	√	√					√	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
SWA04	472964.768	1471306.713	0-1m	√	√	√	√	√	√	√	√					√	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
SWA05	472998.3	1471656.726	0-1m	√	√	√	√	√	√							√	√		√											√	√	√	√	√	√	√
SWA06	472851.613	1471671.941	0-1m	√	√	√	√	√	√	√	√					√	√		√											√	√	√	√	√	√	√
SWA07	472600.375	1471367.72	0-1m	√	√	√	√	√	√							√	√		√											√	√	√	√	√	√	√
SWA08	472415.945	1471471.041	0-1m	√	√	√	√	√	√							√	√		√											√	√	√	√	√	√	√
SWA09	472587.11	1471750.903	0-1m	√	√	√	√	√	√	√	√					√	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
SWA10	472450.917	1472041.038	0-1m	√	√	√	√	√	√	√	√					√	√		√											√	√	√	√	√	√	√
SWA11	472135.854	1471792.278	0-1m	√	√	√	√	√	√							√	√		√											√	√	√	√	√	√	√
SWA12	472031.726	1471562.07	0-1m	√	√	√	√	√	√	√	√					√	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
WQM01	473140.593	1471150.154	~20 cm																											√	√	√	√	√	√	
WQM02	1471626	473026	~5 cm																											√	√	√	√	√	√	
WQM03	472467.797	1472033.041	~20 cm																											√	√	√	√	√	√	
WQM04	472109.947	1471708.097	~30 cm																											√	√	√	√	√	√	
Wet Season - China Camp Reference Surface Water Samples																																				
SWA13	554741.331	1428313.555	0-1m	√	√	√	√	√	√	√	√					√	√		√											√	√	√	√	√	√	√
SWA14	553072.703	1434465.104	0-1m	√	√	√	√	√	√	√	√					√	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
SWA15	553059.878	1434523.213	0-1m	√	√	√	√	√	√	√	√					√	√		√											√	√	√	√	√	√	√
SWA16	555252.077	1428797.746	0-1m	√	√	√	√	√	√	√	√					√	√		√											√	√	√	√	√	√	√
SWA17	555397.501	1429056.024	0-1m	√	√	√	√	√	√	√	√					√	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Wet Season - Wetland Sediment Samples																																				
SED07	473201.779	1471220.993	top 5-10 cm	√	√	√		√	√									√	√	√	√															√
SED08	473089.868	1471419.522	top 5-10 cm	√	√	√		√	√									√	√	√	√															√
SED09	473159.111	1471591.96	top 5-10 cm	√	√	√		√	√	√	√							√	√	√	√	√	√	√	√	√	√	√	√							√

Table B-1. IR Site 2 Sample Locations and Analytical Information (page 8 of 8)

Station ID	Northing	Easting	Depth Interval	Chemical											Physicochemical							Radiological								General Quality						Tox
				PCBs	Pesticides	SVOCs (w/ PAHs)	1,4-Dioxane	VOCs	Metals	Hexavalent Chromium	TPH	Explosives	TBT	PCDD/PCDF	Moisture Content	Alkalinity	Hardness	TOC	Sulfides	Interstitial Salinity	Grain Size	Gross Alpha	Gross Beta	Ra-226	Ra-228	Pb-210	U-234	U-235	U-238	Water Depth	Salinity	Temperature	Dissolved Oxygen	Turbidity	pH	Toxicity/bioaccumulation samples
SED10	472965.91	1471307.723	top 5-10 cm	√	√	√		√	√	√	√							√	√	√	√	√	√	√	√	√	√	√	√							√
SED11	472999.074	1471656.781	top 5-10 cm	√	√	√		√	√									√	√	√	√															√
SED12	472853.087	1471671.346	top 5-10 cm	√	√	√		√	√	√	√							√	√	√	√															√
SED13	472600.375	1471367.72	top 5-10 cm	√	√	√		√	√									√	√	√	√															√
SED14	472415.945	1471471.041	top 5-10 cm	√	√	√		√	√									√	√	√	√															√
SED15	472587.11	1471750.903	top 5-10 cm	√	√	√		√	√	√	√							√	√	√	√	√	√	√	√	√	√	√	√							√
SED16	472450.917	1472041.038	top 5-10 cm	√	√	√		√	√	√	√							√	√	√	√															√
SED17	472135.854	1471792.278	top 5-10 cm	√	√	√		√	√									√	√	√	√															√
SED18	472031.726	1471562.07	top 5-10 cm	√	√	√		√	√	√	√							√	√	√	√															√
Wet Season - China Camp Reference Sediment Samples																																				
SED19	554741.331	1428313.555	0-0.3	√	√	√		√	√	√	√							√	√	√	√															√
SED20	553072.703	1434465.104	0-0.3	√	√	√		√	√	√	√							√	√	√	√	√	√	√	√	√	√	√	√							√
SED21	553059.878	1434523.213	0-0.3	√	√	√		√	√	√	√							√	√	√	√															√
SED22	555252.077	1428797.746	0-0.3	√	√	√		√	√	√	√							√	√	√	√															√
SED23	555397.501	1429056.024	0-0.3	√	√	√		√	√	√	√							√	√	√	√	√	√	√	√	√	√	√	√							√

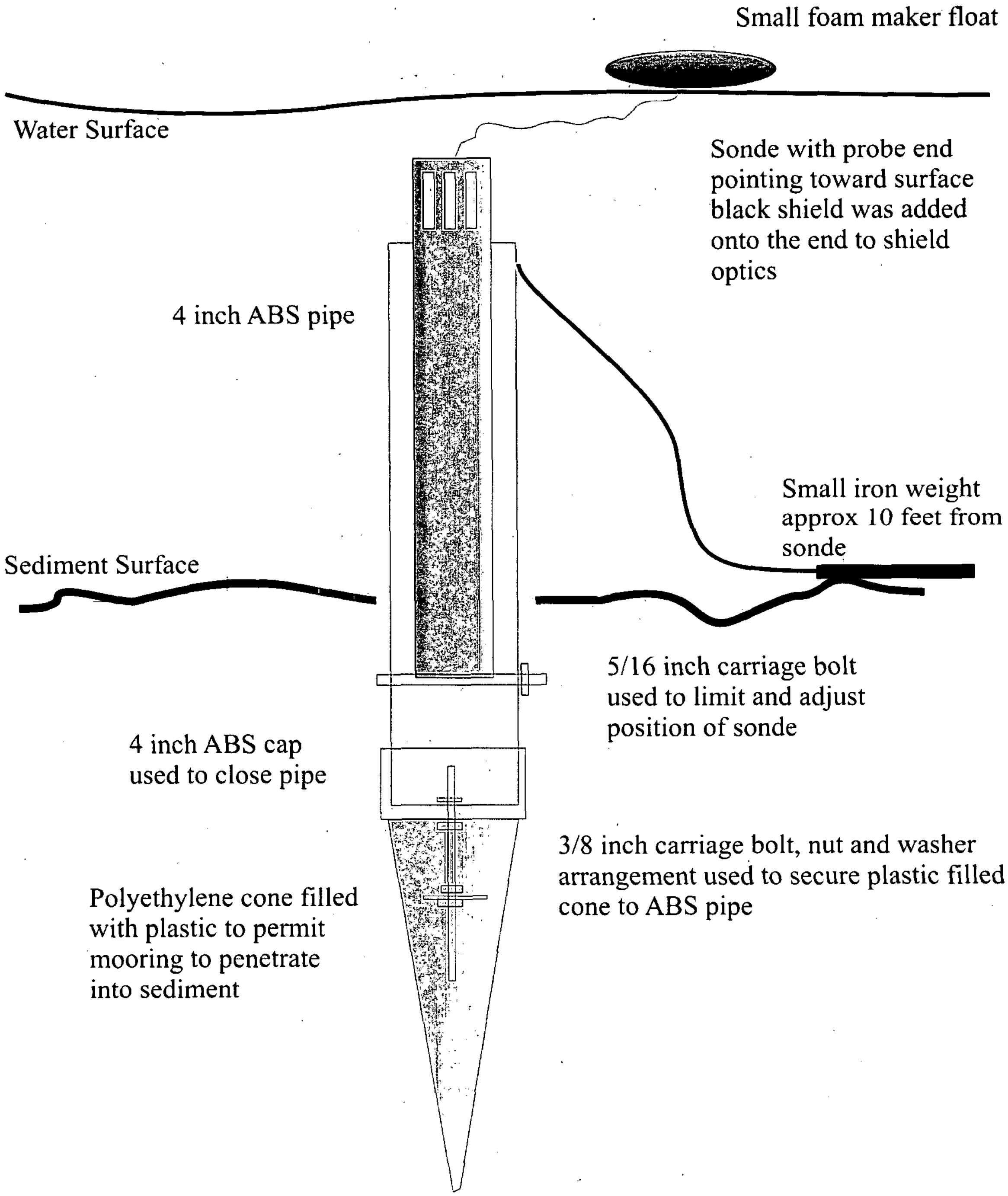


Figure B-4. Schematic Diagram of Vertical Mooring System

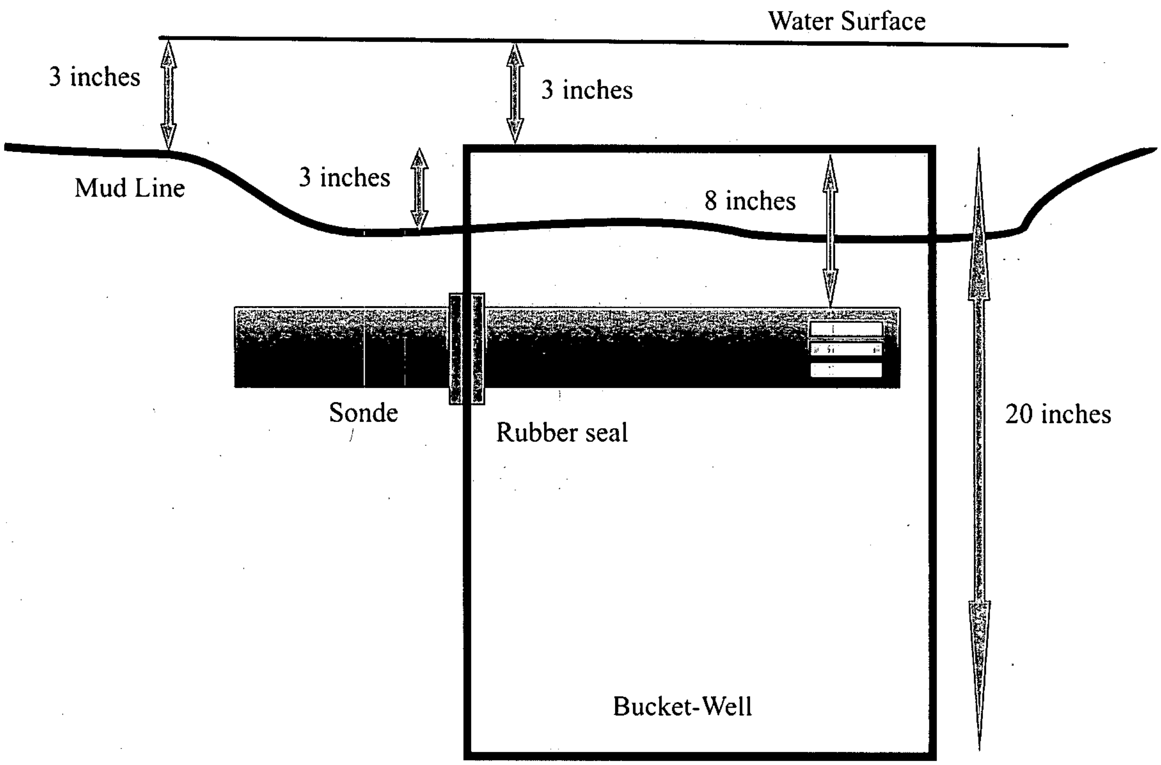


Figure B-5. Schematic Diagram of Bucket-Well Mooring System

2.2 Geophysical Survey

Using existing topographical survey results, previous ordnance and explosives waste (OEW) survey data, other historic site documentation and current surface conditions as guides, a digital geophysical mapping (DGM) investigation was conducted by Power Surveying of Frederick, Colorado at IR Site 2 from September 15 through October 7, 2004. The purpose of the survey was to locate potential buried contamination sources or obstructions (e.g., drums, containers or oil sumps), in order to provide information necessary to complete invasive sampling in optimal locations, and to provide the maximum protection possible to site workers against exposure to potential subsurface hazards. To meet these objectives, the geophysical survey consisted of three primary elements: a preliminary site-wide survey, a secondary follow-up survey of anomaly areas, and a subsequent full coverage survey of areas of potential concern to help guide the invasive investigation activities, as discussed further below.

DGM using state-of-the-art time-domain electromagnetics (TDEM) was considered the most appropriate tool for IR Site 2 to identify potential structures of concern that could be sources of contamination, and/or features that would potentially impede proposed subsurface site characterization activities. A Geonics EM61 MKII electromagnetic instrument was used to collect EM data. In the landfill/interior margin of the site an all terrain vehicle (ATV)-towed array of two TDEM survey units to provide optimal survey coverage. In the wetlands, a single TDEM unit was hand-towed due to terrain limitations. The EM61 MKII systems continuously recorded data at a nominal rate of 5 readings per second (5 Hz), which results in data point spacing along the surveying transects at approximately 0.8 to 1.2 ft. The maximum EM sensor influence depth used for the geophysical survey was approximately 9.8 ft (or 3 m) bgs. During the geophysical survey, horizontal resolution was controlled through the use of a Trimble 5700 Real Time Kinetic (RTK) GPS, which was maintained as per manufacturer specifications during the entire survey at

IR Site 2. All coordinates were recorded in WGS84 Latitude/Longitude and referenced to a local base station control point that was established in GPS autonomous mode. These coordinates were later projected to the NAD27 California State Plane Zone 3 coordinate system. The GPS continuously recorded data at a nominal rate of 1 reading per second (1 Hz), which results in data point spacing along the surveying transects at approximately 4 to 6 ft.

Standard quality control (QC) testing was performed at IR Site 2 during the geophysical survey to ensure quality data were recorded daily. These tests include a cable shake test, static test, and latency test, and were performed in accordance with the United States Army Corp of Engineers (USACE) requirements for OEW detection projects. A cable shake test is conducted to check the cables for their response to vibrations prior to daily data collection. A static test involves recording a static background response and static standard response test at the beginning and end of each day to verify instrument stability, assess noise levels, and determine repeatability of measurements. The static test is performed by collecting data at the same surveyed location on the ground for a minimum of 5 minutes. A latency test is performed to assess the value of the combined EM/GPS system latency for the given instrumentation on a given day. This is conducted because a time lag in the DGM data is known to occur such that a recorded GPS position for a particular EM reading does not coincide with the true ground position for each reading.

The initial geophysical survey was implemented in the landfill/interior margin along traverses of approximately 50-ft spacing. In the wetlands, the survey was implemented along traverses with approximately 25-ft spacing in those areas where data could be collected. The traverses were oriented in a fashion that provided for maximum coverage of the site, and covered the entirety of IR Site 2 to the extent that field conditions allowed (excluding the coastal margin and the berms). An east-west orientation was done first in the landfill, but there were some portions of the interior margin where a north-south orientation provided better coverage of the area. The preliminary survey data was examined for underground anomalies that might indicate the presence of ferrous and/or non-ferrous metallic waste debris, including drums, underground storage tanks (USTs) or OEW, or other subsurface obstructions. The initial survey data indicated widespread geophysical anomalies throughout the landfill and some areas of the interior margin, which led to the implementation of the second element of the survey; perpendicular transects within the landfill and some areas of the interior margin. No additional survey data was required in the wetland following the initial survey.

The final element of the geophysical surveying consisted of completely covering those areas where subsurface anomalies appeared to exist based on the preliminary and secondary surveys. This program allowed the Navy to determine the location of potential subsurface hazards, and provided the maximum possible protection to site workers performing the subsequent invasive activities. The full-coverage program used the same state of the art TDEM equipment as was used during the initial and secondary survey activities, and covered multiple discrete areas within the landfill and one discrete area of the interior margin.

2.2.1 Geophysical Surveying Output

The plate-size diagram provided in Attachment 1 shows the final geophysical survey data output generated at the site, which covered an area of approximately 24 acres. The colors displayed on the plate correlate to the magnitude of EM return, with green representing very low return (or background), blue representing a moderate degree of return, and red representing a significant degree of return and most representative of subsurface metallic anomalies. Surveying data was collected throughout the landfill/interior margin and wetland area with the exception of a few areas where thick vegetation prohibited instrument/operator entry and blocked GPS satellite signal. One of these areas was located in the central portion of the wetland adjacent to the South Pond and the other was located near the former radiological waste shack in the northwestern portion of the interior margin.

Prior to the RI sampling activities, it was anticipated that the geophysical interpretation would primarily consist of the accurate delineation of isolated and/or more expansive regions that share similar waste characteristics. It was understood that it would difficult, if not impossible, to discriminate large, subsurface masses and anomalies as individual drums or construction debris/other routine waste due to the large amount of debris likely present and the expected high background noise of the area. However, accepted practices for implementing and interpreting geophysical surveys were applied in an effort to characterize the subsurface for potential features of concern. Locations where subsurface anomalies were identified in the field were further reviewed in comparison with existing aerial photography of the site, and were also considered when identifying those areas where exploratory trenching would occur in March 2005. Specifically, the locations of anomalies were compared to potential discrete waste disposal areas identified in the *Initial Site Assessment* (E&E, 1983). Prior to initiating the invasive sampling program, proposed soil and/or groundwater sampling locations were relocated a sufficient distance away from anomalies to appropriately characterize features of potential concern, and also to ensure exposure to potential buried hazards did not threaten the health and safety of site workers during invasive activities.

The survey results suggest that the landfill portion of the site is underlain by broadly spread areas of waste in the top 3.3 to 4.9 ft (or 1 to 1.5 m) of the surface, with the magnitude of geophysical response varying considerably. It is not possible to conclude the nature of waste in certain areas or to resolve individual features or clusters of features such as drums or tanks from the geophysical survey data. The geophysical survey results suggest that waste is generally absent from the wetlands except for along the slope leading from the landfill to the wetlands, and two small, relatively low-magnitude anomaly areas in the south-western portion of the wetlands. As with the landfill portion of the site, the geophysical data do not support a conclusion as to the nature of the waste(s) potentially present in the wetlands. Power Surveying generated a final survey report following implementation of the geophysical surveying program, which is provided in Attachment 2.

2.2.2 Subsequent Boring Location Identification

The geophysical data was used to ensure subsurface soil and groundwater sampling was focused in those areas of potential subsurface debris, while also protecting the health and safety of site workers performing invasive sampling activities. After the geophysical survey was completed, the proposed locations of all subsurface borings were assessed with respect to electromagnetic anomaly information. Using the accurate location data associated with the electromagnetic anomaly data, all boring locations to be completed during the RI sampling activities were assigned more precise physical coordinates corresponding to surface locations with a detected electromagnetic response consistent with background. In addition, some sampling locations were shifted to correspond more closely with subsurface anomalies that were observed during the geophysical surveying. The more precise sampling coordinates for each location were derived to allow lateral flexibility in the event that repositioning would be required while in the field due to boring refusal.

2.3 Field Preparation/Mobilization

Field sampling activities at IR Site 2 were conducted in two separate phases: a dry season sampling event conducted October 11-27, 2004, and a wet season sampling event performed March 7-20, 2005. As part of the field effort, extensive preparation was conducted before initiation of the sampling activities. Four analytical laboratories were selected to perform various chemical/bioassay analyses:

- Columbia Analytical Services (CAS) of Kelso, Washington performed all soil and sediment sample processing and the analysis for semivolatile organic compounds (SVOCs), polyaromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), metals, hexavalent chromium, total petroleum hydrocarbons (TPH), explosives, tertbutyltin (TBT), PCDD/PCDF, moisture content, alkalinity, hardness, total organic carbon (TOC), sulfides, interstitial salinity, grain size distribution, and 1,4-dioxane.

- Battelle Duxbury Laboratory of Duxbury, Massachusetts performed all analysis for PCBs and pesticides

- Severn Trent Laboratories (STL) of St. Louis, Missouri performed all analysis for radionuclides including gross alpha, gross beta, radium 226 (Ra-226), radium 228 (Ra-228), lead 210 (Pb-210), isotopic uranium (U-234, U-235, and U-238), and tritium.

- Battelle Marine Sciences Laboratory of Sequim, Washington performed all acute toxicity and bioaccumulation testing of soil, surface water, and sediment samples.

Precision Sampling of Richmond, California provided drilling services during phases of the sampling activities, and Engineering and Remediation Resources Group, Inc. (ERRG) of Concord, California and Power Surveying of Fredrick, Colorado assisted Battelle with the exploratory trenching activities.

Field equipment was mobilized to the IR Site 2 staging yard, located north of IR Site 2 and south of IR Site 1, between August 30 and September 1, 2005. On October 11, 2004, following completion of the geophysical surveying program (see Section 2.2 of this Field Summary Report), the approved sampling locations were located with the aid of a Trimble Geoexplorer® GeoXT™ hand-held GPS unit. On October 12, 2004 a kickoff meeting was held with local Navy personnel and subcontractors to discuss the health and safety plan, the field sampling schedule, and to resolve any outstanding questions or issues prior to the start of sampling activities. The following sections describe all field sampling activities performed to support the RI at IR Site 2 in detail.

3.0: LANDFILL DRY SEASON SAMPLING

Based on the results of a historical data review completed in Section 4.0 the Final RI Sampling Work Plan (Battelle et al., 2005), additional characterization of soil and groundwater in the landfill/interior margin portion of the site was required to complete the RI. Sampling of these environmental media was conducted during two sampling events: one in October 2004 to correspond closely with the dry season at the site; and a second in March 2004 to correspond with the wet season. This section describes the landfill sampling activities that were conducted in the dry season. The majority of soil sampling planned for the landfill was done during the dry season, because it was the easiest time to collect surface and subsurface soil, and data could be collected at a time when water levels were at or near their lowest, thereby maximizing the vadose zone thickness.

Specific sampling procedures, protocols, and analytical methodologies related to the phases of investigation presented in the sections below have previously been described in greater detail in the SAP, which was included as Appendix A of the Work Plan (Battelle et al., 2005). As described in Section 2.2, the geophysical survey was successful in identifying potential subsurface waste disposal areas, which allowed for placement of invasive sampling locations in those areas where potential contamination was more likely to exist. The geophysical survey also provided the maximum amount of protection possible for site workers against potential exposure to any subsurface hazard. In addition to the geophysical survey, routine air monitoring was conducted during all invasive site activities in accordance with the project SHSP. Health and safety air monitoring included regular assessment of the potential presence of volatile organic vapors and radiation using a properly calibrated photoionization detector (PID) and a Ludlum Model 3 survey meter, respectively. The PID and Ludlum Model 3 survey meter also were used to screen soil cores collected from the site for the specific purpose of targeted laboratory analysis.

Photographs of RI field sampling activities performed in the dry season are provided as Attachment 3, on a CD-ROM.

3.1 Soil Sampling

Forty soil cores (SOC01 to SOC40) were completed in the landfill and interior margin at IR Site 2 between October 16 and 24, 2004 (see Figure B-6). At each coring location a boring was advanced to the water table using a DT-6600 remote-operated Geoprobe® unit or a DT-5400 truck-mounted Geoprobe® unit owned and operated by Precision Sampling. In most cases, the borings could be advanced in the location that was proposed based on the geophysical surveying results. In only a few instances, an alternate sampling location needed to be chosen within 5 ft of the original proposed location due to refusal. The soil cores were retrieved from a split spoon sampling device, opened and exposed for screened for organic vapors and radiation using a PID and Ludlum Model 3 survey meter, respectively. The findings from the field screening indicated that neither organic vapors nor radiation were detected above background levels in the field for all of the sampling locations in the landfill/interior margin. The lithology of each core was logged and other pertinent observations (e.g., odor or color) were recorded. In general, the most common lithology observed in the cores from the landfill/interior margin consisted of sandy material. Some silty sand was observed throughout many cores, and clay or clayey sand was generally found in thin lenses at deeper intervals. Fine to medium grained sand intervals were also common at deeper intervals, more prominently at sampling locations in the eastern and northern portions of the landfill/interior margin. Attachment 4-1 includes copies of all soil boring logs for the dry season landfill/interior margin sampling activities.

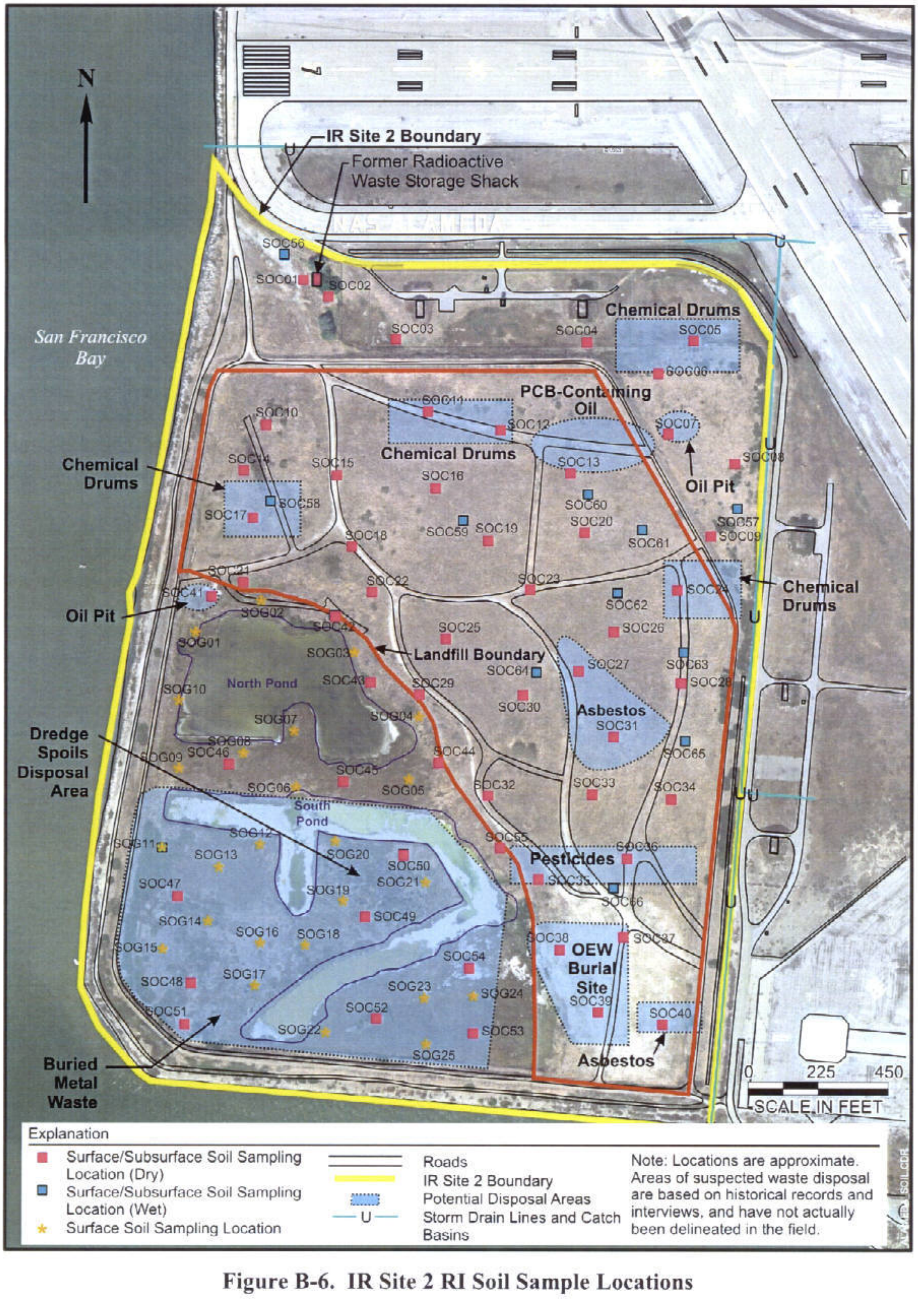


Figure B-6. IR Site 2 RI Soil Sample Locations

After the soil cores were logged, discrete intervals were sampled for laboratory analysis. In general, three soil samples were collected from each boring: one surface sample from 0 to 1 ft bgs, and two subsurface samples from 1 ft to the depth of groundwater. Groundwater was encountered at a minimum and maximum depth of approximately 0.8 ft and 8.7 ft bgs. In some cases only one subsurface soil sample could be collected in low lying areas where groundwater was encountered at 4 ft bgs or above. The subsurface soil samples were collected from intervals exhibiting the greatest potential for contamination based on visual observations and/or field instrument screening results. Waste debris consisting of common refuse such as paper, cardboard, plastic, glass, and wood was observed at of approximately 3 ft bgs across most of the landfill. These observations led to most of the first subsurface soil sampling interval to coincide with the 3 to 4 ft bgs interval. Typically the second subsurface soil sampling interval coincided with the top of the water table, which in many cases was encountered at approximately 8 ft bgs, and thereby commonly defined the second subsurface interval at 7 to 8 ft bgs. At most sampling locations, soil core recovery was fair below the 7 to 8 ft bgs interval because wood and concrete debris resulted in Geoprobe® refusal. Soil samples could not be obtained from this lowest interval at five of the forty sampling locations due to refusal. All sampling locations were either resurveyed (if they were moved from the original proposed location that was cleared based on the geophysical surveying) or reconfirmed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. NAD 27 coordinates for all dry season landfill and interior margin area soil sampling locations (SOC01-SOC40) and the discrete depth intervals sampled at each location are provided in Table B-1.

All soil samples were collected in accordance with protocols outlined in the project sampling and analysis plan (SAP) and shipped under chain of custody to CAS in Kelso, WA for processing and chemical analysis. Sample processing included: homogenization of samples, splitting of required volume for chemical analysis performed by other contracted laboratories, and shipment of required volume to other contract laboratories for chemical analysis. In some cases multiple soil cores were completed within 1 ft of one another in order to collect the required volume of soil for the requested analytical suite. All of the analyses that were completed on soil samples collected from the landfill/interior margin are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs) and moisture content was completed on all soil samples. VOC samples were collected immediately using Encore® samplers.

- Analysis of TPH and hexavalent chromium was completed on approximately 50% of all soil samples, with samples selected from random locations in the field to be representative of various portions of the landfill/interior margin and the various depth intervals sampled.

- Analysis of TOC and grain-size distribution was completed on approximately 25% of all soil samples, with samples selected from random locations in the field to be representative of various portions of the landfill/interior margin and the various depth intervals sampled.

- Analysis of explosive constituents was completed on soil samples from two soil core locations within the historical OEW disposal area in the landfill (SOC-38 and SOC-39 in Figure B-6).

- Analysis of TBT was completed on approximately 20% of all soil samples collected, with samples in the landfill selected at locations along historical roadways (i.e., where sandblast grit was historically disposed) and other areas suspected of potential paint waste disposal.

- Analysis of PCDD/PCDF was completed on soil samples from four sampling locations within the landfill footprint (but not collocated with specific suspected disposal areas or roadways), and two locations outside the landfill footprint to be representative of various portions of the site and the various depth intervals sampled. In addition, supplemental soil cores were collected in the landfill from several locations representing suspected drum and oil/liquid waste disposal areas and from along landfill roadways. Soil samples from some of these supplemental cores were also analyzed for PCDD/PCDF.

- Analysis of radionuclides was completed on soil samples from a total of eight coring locations in the landfill, with samples selected in potential discrete disposal areas, the vicinity of the former radiological waste storage shack, and other portions of the landfill.

Table B-1 summarizes the analytical parameters evaluated for each soil sample collected during the dry season from the landfill and interior margin. Quality assurance/quality control (QA/QC) samples were collected in accordance with the SAP and included field duplicates (at a rate of 10% of all samples) as well as matrix spike/matrix spike duplicate (MS/MSD) samples. Equipment rinsate blanks were also collected at the end of each day for which sampling was performed in the field. All boreholes were abandoned using bentonite chips following soil sampling activities.

Following sample collection, excess soil material was maintained as investigative derived waste (IDW) and, because the residual soil material was minimal, it was all containerized in a 55-gallon drum. All soil sampling equipment was decontaminated between each sample location according to procedures described in the SAP, and the decontamination waste water was also drummed as IDW in a separate labeled 55-gallon drum. Both soil and water were sampled from respective IDW drums and characterized as non-hazardous waste. A non-hazardous waste manifest, which is provided in Attachment 5, was generated by the waste disposal vendor, and the IDW was subsequently shipped to an approved landfill.

3.2 Groundwater Sampling

Groundwater samples were collected across the landfill to identify potential contaminant source zones and to assist with evaluating contaminant transport in the aqueous phase. Similar to soil samples, the groundwater sampling locations were biased towards areas of suspected contamination (e.g., potential drum disposal areas and oil sumps). A total of 13 temporary groundwater monitoring wells (HYP01-HYP13) were sampled between October 18 and 21, 2004 within the landfill and interior margin portions of IR Site 2, as depicted in Figure B-7. Temporary well casings were installed within the same borings that soil samples were collected. After soil samples had been collected to the top of the water table, the Geoprobe® continued to advance approximately 5 ft beyond the groundwater surface. All Geoprobe® rods were extracted and a temporary 1-inch diameter schedule-40 polyvinyl chloride (PVC) casing with a 5-ft screen at the bottom was set within the borehole. The casing was capped and allowed to settle while groundwater levels equilibrated. Although all groundwater sampling locations corresponded with a soil sample location, the HYP locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. The NAD 27 coordinates for all dry season landfill and interior margin area groundwater sampling locations are tabulated in Table B-1.

At each location, water levels were recorded to the nearest 0.01 ft from ground surface using an electronic water level indicator. A battery-operated Geotech® peristaltic pump was used to purge and sample the temporary wells under low-flow conditions. At a few locations (HYP09, HYP11, and HYP12), the temporary monitoring wells were dry and were subsequently reset to a slightly greater depth to allow groundwater to be purged and sampled. Dedicated polyethylene tubing was utilized at each location and

Figure B-7. IR Site 2 RI Groundwater Sample Locations

it was discarded after use at a single well. Each well was first purged at a low flow rate until groundwater was visibly clear, at which point pH, conductivity, and salinity were measured and recorded using a YSI 6600 EDS multi-parameter water quality meter. Some noticeable odors were noted by the sampling crew at the temporary wells, but the PID never measured volatile organic vapors above background levels.

All groundwater samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody directly to the appropriate contracted analytical laboratories for chemical analysis. All of the analyses that were completed on groundwater samples collected from the landfill/interior margin are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, and SVOCs (including PAHs and 1,4-dioxane) was completed on all groundwater samples.

- Analysis of TPH and hexavalent chromium was completed on approximately 50% of all (or 7 of 13) groundwater samples, with samples selected from random locations in the field to be representative of various portions of the site.

- Analysis of radionuclides was completed on approximately 25% of all (or 4 of 13) groundwater samples, with samples selected from locations near soil cores evaluated for radionuclides (gross alpha, gross beta, Ra-226, Ra-228, Pb-210, and isotopic uranium).

- Analysis of explosive constituents was completed on groundwater samples collected from the two landfill area groundwater sampling locations nearest the historical OEW disposal area.

Two sets of groundwater samples were collected at each sampling location. One was analyzed unfiltered and the second was filtered at the laboratory prior to analysis. The filtered and unfiltered data were necessary to allow turbidity effects to be evaluated, as the direct-push groundwater sampling produced a significant amount of sample turbidity, and elevated sample turbidity can artificially elevate groundwater concentrations of constituents that strongly sorb to soil (e.g., PCBs and metals). Filtration was only conducted for analyses for which filtration was appropriate (metals, PCBs, pesticides, SVOCs, and radionuclides), and was specifically not conducted for VOC analyses.

Table B-1 provides a detailed list of the analytical parameters evaluated for each groundwater sample collected during the dry season from the landfill and interior margin. QA/QC samples were collected and included field duplicates (at a rate of 10% of all samples) and MS/MSD samples. Equipment rinsate blanks were not collected because dedicated sample tubing was used at each location. Copies of groundwater purging and sampling logs for the dry season landfill area groundwater sampling stations are presented in Attachment 4-2. All temporary well borings were abandoned by removing the well casings and sealing the borings with bentonite chips.

The schedule for groundwater sampling activities inside the landfill was coordinated as closely as possible with the quarterly groundwater monitoring program for wells that exist along the boundary between the landfill and the wetland and along the bay. The quarterly monitoring event at IR Site 2 was conducted around November 10, 2004. The data collected during these two separate activities was combined to provide a more complete understanding of the nature and extent of contamination in groundwater and hydrologic conditions at the site.

4.0: WETLAND AND WETLAND POND DRY SEASON SAMPLING

Based on the results of a historical data review completed in Section 4.0 the Final RI Sampling Work Plan (Battelle et al., 2005), additional characterization of soil, groundwater, sediment, and surface water in the wetland portion of the site was required to complete the RI. Sampling of soil and groundwater occurred in October 2004, while sampling of sediment and surface water was conducted during two sampling events: one in October 2004 to correspond closely with the dry season at the site; and a second in March 2004 to correspond with the wet season. This section describes the wetland sampling activities that were conducted in the dry season, which includes soil, groundwater, surface water and sediments. All of soil and groundwater sampling planned for the wetland was done during the dry season, because it was the easiest time to collect surface and subsurface soil in the wetland, and data could be collected at a time when water levels were at or near their lowest, thereby maximizing the vadose zone thickness.

Specific sampling procedures, protocols, and specific analytical methodologies related to the phases of investigation presented in the sections below have previously been described in greater detail in the SAP, which was included as Appendix A of the Work Plan (Battelle et al., 2005). As described in Section 2.2, the geophysical survey results suggest that waste is generally absent from the wetlands except for along the slope leading from the landfill to the wetlands, and two small, relatively low-magnitude anomaly areas in the southwestern portion of the wetlands. One wetland sampling location (SOC51/HYP19) was moved to be closer to the low-magnitude anomaly in the southwestern portion of the wetlands and confirm there were not negative impacts in the area. Routine air monitoring was conducted during all invasive site activities in accordance with the project SHSP. Health and safety air monitoring included regular assessment of the potential presence of volatile organic vapors and radiation using a properly calibrated PID and a Ludlum Model 3 survey meter, respectively. The PID and Ludlum Model 3 survey meter also were used to screen soil cores collected from the site for the specific purpose of targeted laboratory analysis.

4.1 Soil Sampling

A total of 40 soil cores were investigated using a DT-6600 remote-operated Geoprobe® unit in the IR Site 2 wetlands between October 12 and 15, 2004 (see Figure B-6). In most all cases, the borings could be advanced in the location that was proposed in the Final Work Plan (Battelle et al., 2005) or based on geophysical data. In only a few instances, an alternate sampling location needed to be chosen within 5 ft of the original proposed location due to refusal. The soil cores were retrieved from a split spoon sampling device, and screened for organic vapors and radiation using a PID and Ludlum Model 3 survey meter, respectively. The findings from the field screening indicated that neither organic vapors nor radiation were detected above background levels in the field for all sampling locations in the landfill/interior margin. The lithology of each core was logged and other pertinent observations (e.g., odor or color) were recorded. The lithology observed in most cores consisted generally of silty sand or silty to sandy clay material. Root intrusions were frequently observed. Copies of boring logs for the dry season wetland area soil sampling locations are presented in Attachment 4-3.

After the soil cores were logged, discrete intervals were sampled for laboratory analysis. In the wetland, 25 of the 40 soil coring locations (SOG01-SOG25) were only sampled at the surface (0 to 1 ft bgs) while the other 15 soil coring locations (SOC41-SOC55) were sampled at the surface (0 to 1 ft bgs) and subsurface (1 ft to the depth of groundwater). Groundwater was generally encountered between 2 and 4 ft bgs in the wetland, so at most boring locations only one subsurface soil sample could be collected. The deepest and shallowest depth to groundwater measured in the wetland was 1 ft and 12 ft bgs, respectively, but the deep groundwater level of 12 ft bgs seemed to be an outlier because the next deepest level was 8.9 ft bgs. Two subsurface soil samples could be collected at 3 of 15 locations: SOC44, SOC50, and SOC55. The subsurface soil samples were to be collected from intervals exhibiting the greatest potential for contamination based on visual observations and/or field instrument screening results; however, no field screening results were above background levels and no contamination or waste debris was observed during field activities in the wetlands. Due to the shallow groundwater encountered in the wetland, the subsurface soil sampling interval usually corresponded with 1 to 2 ft bgs or 2 to 3 ft bgs interval. All sampling locations were either resurveyed (if they were moved from the original proposed location that was cleared based on the geophysical surveying) or reconfirmed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. NAD 27 coordinates for all dry season wetland area soil sampling locations (SOC41 to SOC55 and SOG01 to SOG25) and the discrete depth intervals sampled at each location are provided in Table B-1.

All soil samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody to CAS for processing and chemical analysis. In some cases multiple soil cores were completed within 1 ft of one another in order to collect the required volume of soil for the requested analytical suite. All of the analyses that were completed on soil samples collected from the wetland are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs) and moisture content was completed on all soil samples. VOC samples were collected immediately using Encore® samplers.

- Analysis of TPH and hexavalent chromium was completed on approximately 50% of all soil samples, with samples selected from random locations in the field to be representative of various portions of the wetland and the various depth intervals sampled.

- Analysis of TOC and grain-size distribution was completed on approximately 25% of all soil samples, with samples selected from random locations in the field to be representative of various portions of the wetland and the various depth intervals sampled.

- Analysis of TBT was completed on approximately 20% of all soil samples collected, with samples in the wetlands from random locations to be representative of various portions of the site and the various depth intervals sampled.

- Analysis of PCDD/PCDF was completed on soil samples from four sampling locations within the wetland area selected randomly to be representative of various portions of the site and the various depth intervals sampled.

- Analysis of radionuclides was completed on soil samples from a total of four coring locations in the wetlands, coinciding with cores sampled for PCDD/PCDF.

Table B-1 summarizes the analytical parameters evaluated for each soil sample collected during the dry season from the wetland. QA/QC samples were collected in accordance with the SAP and included field duplicates (at a rate of 10% of all samples) as well as MS/MSD samples. Equipment rinsate blanks were also collected at the end of each work day in the field. All boreholes were abandoned using bentonite chips following soil sampling activities.

Following sample collection, excess soil material was maintained with IDW from the landfill sampling activities in the same containerized in a 55-gallon drum. All soil sampling equipment was decontaminated between each sample location according to procedures described in the SAP, and the decontamination waste water was also drummed as IDW in a separate labeled 55-gallon drum. Both soil and water were sampled from respective IDW drums and characterized as non-hazardous waste. A non-hazardous waste manifest, which is provided in Attachment 5, was generated by the waste disposal vendor, and the IDW was subsequently shipped to an approved landfill.

4.2 Groundwater Sampling

Groundwater samples were collected within the wetland area to identify potential contaminant and to assist with evaluating contaminant transport in the aqueous phase. The groundwater sampling locations in the wetland area were chosen to provide reasonable coverage of the area because there are no areas of suspected contamination in the wetland to bias sampling toward. A total of 7 temporary groundwater monitoring wells (HYP14-HYP20) were sampled between October 18 and 21, 2004 within the wetland of IR Site 2, as depicted in Figure B-7. Temporary well casing was installed within the same borings that soil samples were collected. After soil samples had been collected to the top of the water table, the Geoprobe® continued to advance approximately 5 ft beyond the groundwater surface. All Geoprobe® rods were extracted and a temporary 1-inch-diameter Schedule 40 PVC casing with a 5-ft screen at the bottom was set within the borehole. The casing was capped and allowed to settle while groundwater levels equilibrated. Although all groundwater sampling locations coincided with a soil sample location, the HYP locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. The NAD 27 coordinates for all dry season wetland area groundwater sampling locations are tabulated in Table B-1.

At each location, water levels were recorded to the nearest 0.01 ft from ground surface using an electronic water level indicator. A battery-operated Geotech® peristaltic pump was used to purge and sample the temporary wells under low-flow conditions. The temporary well at location HYP15 could not be sampled because it was dry. The field sampling team found a nearby unmarked monitoring well located approximately 33 ft southeast of HYP15 and found that it was screened in the same interval as the other HYP locations in the wetland. A groundwater sample was collected from the nearby unmarked monitoring well and labeled HYP15 to ensure a data point was obtained from this area of the wetland. All figures show HYP15 in the same location as the unmarked monitoring well. Dedicated polyethylene tubing was utilized at each location for purging and sampling and it was discarded after use at a single well. Each well was first purged at a low purge rate until groundwater was visibly clear, at which point pH, conductivity, and salinity were measured and recorded using a YSI 6600 EDS multi-parameter water quality meter. No odors were noted by the sampling crew at the temporary wells within the wetland area.

All groundwater samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody directly to the appropriate contracted analytical laboratories for chemical analysis. All of the analyses that were completed on groundwater samples collected from the wetland are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, and SVOCs (including PAHs and 1,4-dioxane) was completed on all groundwater samples.
- Analysis of TPH and hexavalent chromium was completed on approximately 50% of all (or 4 of 7) groundwater samples, with samples selected from random locations in the field to be representative of various portions of the wetland.
- Analysis of radionuclides (gross alpha, gross beta, Ra-226, Ra-228, Pb-210, and isotopic uranium) was completed on approximately 25% of all (or 2 of 7) groundwater samples, with samples selected from locations near soil cores evaluated for the same parameter.

- Analysis of explosive constituents was completed on a groundwater sample collected from the one wetland area groundwater sampling location nearest the historical OEW disposal area.

Two sets of groundwater samples were collected at each sampling location. One was analyzed unfiltered and the second was filtered at the laboratory prior to analysis to allow turbidity effects to be evaluated for constituents that strongly sorb to soil (e.g., PCBs and metals). Filtration was specifically not conducted for VOC analyses.

Table B-1 provides a detailed list of the analytical parameters evaluated for each groundwater sample collected during the dry season from the wetland. QA/QC samples were collected and included field duplicates (at a rate of 10% of all samples) and MS/MSD samples. Equipment rinsate blanks were not collected because dedicated sample tubing was used at each location. Copies of groundwater purging and sampling logs for the dry season wetland sampling stations are presented in Attachment 4-4. All temporary well borings were abandoned by removing the well casings and sealing the borings with bentonite chips.

The schedule for groundwater sampling activities inside the wetland was coordinated as closely as possible with the quarterly groundwater monitoring program for wells that exist along the boundary between the landfill and the wetland and along the bay. The quarterly monitoring event at IR Site 2 was conducted around November 10, 2004. The data collected during these two separate activities was combined to provide a more complete understanding of the nature and extent of contamination in groundwater and hydrologic conditions at the site.

4.3 Sediment Sampling

Sediment cores were collected from discrete locations in the North Pond and the South Pond during the dry season sampling event. The sediment cores were completed in the area around the perimeter of the wetland ponds that is not inundated (but showed evidence of being seasonally inundated). A total of 6 sediment cores were investigated using hand coring techniques in the IR Site 2 wetlands ponds on October 12 and 13, 2004 (see Figure B-8). Three of the dry season sediment cores were located in the area of the North Pond (SDC01-SDC03) and three were in the area of the South Pond (SDC04-SDC07). Sediment cores were collected by hand using 4-inch diameter aluminum tubing lined with cellulose acetate butyrate (CAB) tubing and fitted with a stainless steel cutting edge and core catcher. The coring assembly was advanced into the sediment to a depth of 36 inches by using a sledge hammer and then extracted and placed on a clean table for logging and processing. See photographs of the sediment coring activities in Attachment 3. The CAB liners were retrieved from the aluminum tube, and screening for organic vapors and radiation using a PID and Ludlum Model 3 survey meter, respectively. The findings from the field screening indicated that neither organic vapors nor radiation were detected above background levels in the field for all sediment sampling locations in the wetland ponds. The lithology of each core was logged and other pertinent observations (e.g., odor or color) were recorded. In general, the most common lithology observed in the North Pond sediment cores consisted of a black silty clay. In the South Pond, the most common lithology in the sediment cores was a black to grayish brown fine to medium grained sand with some silty clay. Hydrogen sulfide (H_2S) odors were observed in South Pond sediment samples, but not in the North Pond samples. Copies of boring logs for the dry season sediment cores collected from the wetland ponds are presented in Attachment 4-5.

After the sediment cores were logged, three discrete intervals were sampled for laboratory analysis: 0-0.3 ft, 0.3 ft-1 ft, and 1ft-3 ft. VOC samples were collected immediately using Encore® samplers and then the exposed ends of each core interval was lined with Teflon® film, capped with clean polyethylene covers, which were in turn taped to the tubing for shipment to the analytical laboratory. All sampling

Figure B-8. IR Site 2 RI Sediment Sample Locations

locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. NAD 27 coordinates for all dry season sediment coring locations (SDC01-SDC06) and the discrete depth intervals sampled at each location are provided in Table B-1.

All sediment samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody to CAS for processing and chemical analysis. All of the analyses that were completed on sediment core samples collected in the dry season from the wetland ponds are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, and SVOCs (including PAHs) was completed on all sediment samples.

- Analysis of hexavalent chromium and TPH was completed on approximately 50% of all sediment samples, with samples selected from random locations and depths.

Table B-1 summarizes the analytical parameters evaluated for each sediment core sample collected during the dry season from the wetland ponds. QA/QC samples were collected in accordance with the SAP and included field duplicates (at a rate of 10% of all samples) as well as matrix spike/matrix spike duplicate (MS/MSD) samples. Equipment rinsate blanks were also collected at the end of day during which sampling was performed in the field. No IDW was produced from the sediment coring activities in the dry season.

4.4 Surface Water Sampling

Surface water samples were collected from the wetland ponds to identify potential contamination and to assist with evaluating contaminant transport at the site. A total of 6 locations were sampled for surface water in the North Pond (SWA01 to SWA06) and 4 locations in the South Pond (SWA09 to SWA12) on October 14 and 15, 2004, as depicted in Figure B-9. The proposed surface water sampling locations SWA07 and SWA08 could not be sampled in the dry season because the South Pond was dry in these areas. In fact, the North Pond and South Pond were very shallow (1 to 6 inches in depth) in those areas that were inundated with water during the dry season sampling event; therefore, a battery-operated Geotech® peristaltic pump was used to purge and sample each of the surface water sampling locations under low-flow conditions to reduce disturbance to the sediments. Dedicated polyethylene tubing was utilized by attaching one end of the tubing to a PVC pipe that had been pounded into the sediment at each surface water sampling location. The intake end of the sample tubing was submerged approximately 1 inch below the water surface and the remainder of the tubing was run toward the shore line and attached to the peristaltic pump. Each sampling location was first purged at a low flow rate until the surface water was visibly clear, at which point pH, conductivity, and salinity were measured and recorded using a YSI 6600 EDS multi-parameter water quality meter. The pump was then used to collect surface water samples directly into the appropriate containers. All SWA locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. The NAD 27 coordinates for all dry season wetland pond surface water sampling locations are tabulated in Table B-1.

All surface water samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody directly to the appropriate contracted analytical laboratories for chemical analysis. All of the analyses that were completed on surface water samples collected from the wetland ponds are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs and 1,4-dioxane), alkalinity, and hardness was completed on all surface water samples.

Figure B-9. IR Site 2 RI Surface Water Sample Locations

- Analysis of hexavalent chromium and TPH was completed on approximately 50% of all surface water samples from each pond, with samples selected randomly.

- Analysis of radionuclides (gross alpha, gross beta, Ra-226, Ra-228, Pb-210, and isotopic uranium) was completed on approximately 33% of all surface water samples from each pond, with samples selected randomly.

As with all groundwater samples, two sets of surface water samples were collected at each sampling location. One was analyzed unfiltered and the second was filtered at the laboratory prior to analysis to address elevated turbidity typical of a shallow water body, which can artificially elevate groundwater concentrations of constituents that strongly sorb to soil (e.g., PCBs and metals). Filtration was only conducted for analyses for which filtration was appropriate (metals, PCBs, pesticides, SVOCs, and radionuclides), and was specifically not conducted for VOC analyses.

Table B-1 provides a detailed list of the analytical parameters evaluated for each surface water sample collected from the wetland ponds during the dry season. QA/QC samples were collected and included field duplicates (at a rate of 10% of all samples) and MS/MSD samples. Equipment rinsate blanks were collected at the end of each day that surface water sampling was performed. Copies of surface water purging and sampling logs for the dry season wetland pond sampling stations are presented in Attachment 4-6.

5.0: LANDFILL WET SEASON SAMPLING

Based on a preliminary review of field observations and analytical data collected during dry season (October 2004) sampling activities, some additional soil and groundwater sampling was performed in the landfill and interior margin portions of IR Site 2 between March 8 and 14, 2004 to fill minor data gaps and to supplement the dry season field sampling dataset. The March 2005 sampling was not intended to constitute a delineation effort, but was instead intended to augment the existing RI dataset. The soil and groundwater sampling procedures and protocols followed in March 2005 were identical to those followed in October 2004.

Exploratory trenches were also completed in March 2005 based on October 2004 analytical data and the results of the geophysical surveying described in Section 2.2. Soil samples were collected from the trenches to further augment the site characterization dataset, and observations were made of the types of waste found in the exploratory trenches. In addition, plant, small mammal and invertebrate tissue sampling was performed in the landfill and interior margin of IR Site 2 in March 2005 because ecological resources were more abundant and organism populations/communities more representative compared to the dry season. The following subsections describe the landfill/interior margin sampling activities that were conducted in March 2005.

5.1 Soil Sampling

Eleven soil cores (SOC56 to SOC66) were completed in the landfill and interior margin at IR Site 2 on March 10, 2005 (see Figure B-6). At each coring location a boring was advanced to the water table using a Geoprobe® unit. In almost all cases, the borings could be advanced in the location that was proposed because refusal was not encountered. Similar to soil sampling in the dry season, the soil cores were retrieved from a split spoon sampling device and screened for volatile organic vapors and radiation using a PID and Ludlum Model 3 survey meter, respectively. No organic vapors or radiation was detected above background levels in any soil sampling intervals. The lithology of each core was logged and other pertinent observations were recorded on field log sheets that are included in Attachment 4-7. In general, the most common lithology observed in the cores consisted of silty sand. Clay or clayey sand was only observed in a few soil cores. Fine to medium grained sand intervals were commonly observed at deeper intervals.

Again similar to dry season sampling, after cores were logged, discrete intervals were sampled for laboratory analysis. As many as three soil samples were collected from each boring depending on the depth to groundwater: one surface sample from 0 to 1 ft bgs, and two subsurface samples from 1 ft to the depth of groundwater. Groundwater was encountered at significantly shallower depths (i.e., generally between 4 and 5 ft bgs) during the wet season than the dry season, which resulted in only one subsurface soil sample being collected at 7 of the 11 locations. Subsurface soil samples were collected from intervals exhibiting the greatest potential for contamination based on visual observations and/or field screening results; however, little to no waste material was observed or odors noticed. When visible waste debris was encountered, it was usually observed at approximately 3 ft bgs and consisted of plastic, glass, and wood debris. At most sampling locations, sample recovery was good. All sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. NAD 27 coordinates for all wet season landfill and interior margin area soil sampling locations (SOC55-SOC 66) and the discrete depth intervals sampled at each location are provided in Table B-1.

All soil samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody to CAS in Kelso, WA for processing and chemical analysis. In some cases multiple soil cores were completed within 1 ft of one another in order to collect the required volume of soil for the requested analytical suite. The following list summarizes the analyses that were completed on soil samples collected from the landfill/interior margin in the wet season to fill minor data gaps and augment the dry season RI dataset:

- SOC-56 soil samples analyzed for metals, PCBs, SVOCs (including PAHs), Ra-226, and Ra-228
- SOC-57 soil samples analyzed for metals and PCDD/PCDF
- SOC-58 soil samples analyzed for metals, SVOCs (including PAHs), and PCDD/PCDF
- SOC-59 soil samples analyzed for metals, SVOCs (including PAHs), and PCDD/PCDF
- SOC-60 soil samples analyzed for metals and PCDD/PCDF
- SOC-61 soil samples analyzed for metals, PCDD/PCDF, Ra-226, and Ra-228
- SOC-62 soil samples analyzed for metals, PCDD/PCDF, Ra-226, and Ra-228
- SOC-63 soil samples analyzed for PCDD/PCDF, Ra-226, and Ra-228
- SOC-64 soil samples analyzed for metals and SVOCs (including PAHs)
- SOC-65 soil samples analyzed for PCDD/PCDF
- SOC-66 soil samples analyzed for SVOCs (including PAHs), Ra-226, and Ra-228

Table B-1 summarizes the analytical parameters evaluated for each soil sample collected during the wet season from the landfill and interior margin and all of the sampling locations are shown in Figure B-6. QA/QC samples were collected in accordance with the SAP and included field duplicates (at a rate of 10% of all samples) as well as MS/MSD samples. Equipment rinsate blanks were also collected at the end of each day when sampling was performed in the field. All boreholes were abandoned following soil sampling activities using bentonite chips.

Following sample collection, excess soil material was maintained as IDW and, because the residual soil material was minimal, it was all containerized in a 55-gallon drum. All soil sampling equipment was decontaminated between each sample location according to procedures described in the SAP, and the decontamination waste water was also drummed as IDW in a separate labeled 55-gallon drum. Both soil and water were sampled from respective IDW drums and characterized as non-hazardous waste. A non-hazardous waste manifest, which is provided in Attachment 5, was generated by the waste disposal vendor, and the IDW was subsequently shipped to an approved landfill.

5.2 Groundwater Sampling

A total of 3 temporary groundwater monitoring wells (HYP21 to HYP23) were sampled on March 14, 2005 within the landfill, as depicted in Figure B-7. The same sampling procedure that was followed in the dry season was followed in the wet season (refer to Section 3.2). The NAD 27 coordinates for all wet season landfill groundwater sampling locations are tabulated in Table B-1. All groundwater samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody directly to the appropriate contracted analytical laboratories for chemical analysis. All of the analyses that were completed on groundwater samples collected from the landfill in the wet season are summarized as follows:

- HYP-21 groundwater samples analyzed for PCBs, pesticides, metals, VOCs, 1,4-dioxane, explosives and radionuclides (gross alpha, gross beta, Ra-226, Ra-228, Pb-210, and isotopic uranium).

- HYP-22 groundwater samples analyzed for PCDD/PCDF.

- HYP-23 groundwater samples analyzed for PCDD/PCDF.

Like dry season groundwater sampling, two sets of groundwater samples were collected at HYP-21. One was analyzed unfiltered and the second was filtered at the laboratory prior to analysis. Filtration was only conducted for analyses for which filtration was appropriate (metals, PCBs, pesticides, SVOCs, and radionuclides), and was specifically not conducted for VOC analyses.

Table B-1 provides a detailed list of the analytical parameters evaluated for each groundwater sample collected from the landfill during the wet season. QA/QC samples were collected and included field duplicates (at a rate of 10% of all samples) and MS/MSD samples. Equipment rinsate blanks were not collected because dedicated sample tubing was used at each location. Copies of groundwater purging and sampling logs for the wet season landfill area groundwater sampling stations are presented in Attachment 4-8. All temporary well borings were abandoned by removing the well casings and sealing the borings with bentonite chips.

5.3 Exploratory Trenching and Trench Sampling

Five exploratory trenches (TRN01 to TRN05) were excavated on March 8 and 9, 2005 within the landfill area, focusing in areas that were considered likely to contain significant volumes of waste material based on geophysical survey results, analytical chemistry results from the dry season field sampling or historical sampling efforts, historical aerial photography, and/or historical information on site-specific disposal practices. The purpose of the trenches was to characterize the nature, type, and condition of the waste disposed at the site, and to determine the typical depth of waste placement. The five trenching locations are shown on Figure B-10.

All of the trenches were completed in the landfill area of the site. In some cases, the trenches were completed in locations coinciding with discrete waste disposal areas summarized in historical site information. Because the geophysical survey and dry season sampling data did not suggest the presence of significant waste material in the wetlands, and given the highly saturated conditions present in the wetlands during the wet season, no trenches were completed in the wetland portion of the site.

Battelle coordinated the exploratory trenching activities with ERRG, a local environmental contractor. Power Surveying also had 2 OEW technicians onsite during exploratory trenching activities to screen the trenching areas with a hand-held magnetic locator (i.e., Schonstedt) prior to and during excavation activities. A PID was used at all times during the exploratory trenching to check the workers breathing zone and excavated soils for volatile organic vapors. In addition, the excavated soils were screened for radiation using a Ludlum Model 3 survey meter. No organic vapors or radiation was measured above background levels in the field during the exploratory trenching activities. The general progression of the trenching activities at each trench location is as follows:

- Each proposed trench was located with a hand-held Trimble Geoexplorer® GeoXT™ GPS unit and marked using surveying flags. NAD 27 coordinates for all trench locations (TRN01-TRN05) and the discrete depth intervals sampled at each trench are provided in Table B-1. All trenches had approximate dimensions of 3 ft wide (i.e., width of the backhoe bucket) and 25 ft long.

- Field personnel mobilized the necessary equipment such as a backhoe, and all health and safety monitoring equipment (Schonstedt, PID, and Ludlum Model 3 survey meter) to the trenching location.

Figure B-10. IR Site 2 RI Exploratory Trench Locations

- OEW technicians screened the surface in the area of the trench for potential OEW or large metallic objects that might serve as a risk to the field sampling personnel. Note that there was generally always some metal in the form of wire or cable debris near the surface of each trench that was identified by the Schonstedt. Trenching was still conducted in these areas. The Schonstedt meter OEW technicians were onsite to help guide the trenching activities safely and carefully. In fact, the exploratory trenching activities were intended to uncover metallic waste such as buried drums if they existed at the site. In some cases, the location of the trench was adjusted slightly based on the surface screening with the Schonstedt meter. After the area was cleared, trenching was started by carefully excavating the clean landfill cover soil and segregating it on 5-mil plastic that was laid out next to the trench.

- After the clean cap material was removed, waste and debris was excavated and segregated on 5-mil plastic next to the trench. Waste was observed as it was removed from the trench and after it had been placed on the plastic, and in some instances, if the backhoe operator or a site worker observed an unknown object or something that was considered a potential danger, trenching was halted and the situation was assessed. At no time was trenching stopped for more than a short time (i.e., <5 minutes), because only common waste that was of no concern to the workers health and safety was encountered. All health and safety measurements and waste debris observations were recorded on trench logs that are provided in Attachment 4-9.

- At the depth of groundwater, trenching was stopped and soil sampling was performed. Soil samples were collected from the sidewall of each trench at varying depths depending on the depth to groundwater. Chemical analyses for the trench samples and are defined below.

- After soil sampling was done and video/photographs had been taken, the waste/debris was placed back into the trench. The waste/debris was then compacted and the clean cap material was used to cover the trenches.

The depth to groundwater varied at each trench location depending mostly on topography at the site. In TRN02 groundwater was encountered at approximately 1.5 ft bgs while at TRN05 it was encountered at approximately 8.5 ft bgs. High-intensity artificial lights were used to illuminate the sidewalls of the open trenches, and both still photographs and video were taken to document the excavation activities. Videography of 4 out of the 5 trenches and photographs that were taken during the trenching activities are provided on a cdrom in Attachment 3.

Waste debris was encountered at varying depths within the trenches generally starting between 1.5 ft and 3.5 ft bgs (1.5 ft bgs at TRN04; 3.5 ft bgs at TRN05; 2.0 ft at TRN03; and 1.5 ft at TRN02 and TRN01). A wide variety of waste and debris was encountered during the trenching activities including glass, plastic (e.g., sheeting and toys), metal (e.g., posts, sheet metal, and siding), wood, canvas, paper, concrete, rubber (e.g., tires and hose), cable, boots, Styrofoam, carpeting, fabric, film, microfiche, and a newspaper dated December 15, 1975. Because groundwater was encountered at a shallow depth at trench locations TRN01, TRN02, and TRN03, only small quantities of debris were uncovered and exposed, but what was uncovered was similar to the waste and debris that has been observed at other, deeper trenches.

Soil samples were collected from the trench sidewalls at various depth intervals from all trenches. Three sidewall soil samples were collected from TRN04 (0-1 ft bgs, 1-3 ft bgs, and 3-6 ft bgs), four from TRN05 (0-1 ft bgs, 1-3 ft bgs, 3-5 ft bgs, and 5-8 ft bgs), and two from TRN01, TRN02 (0-1 ft bgs and

1-2 ft bgs) and TRN03 (0-1 ft bgs and 1-3 ft bgs). Field screening of all samples revealed no volatile organic vapors or radiation above background levels measured at in the field.

All soil samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody to CAS in Kelso, WA for processing and chemical analysis. The following list summarizes the analyses that were completed on soil samples collected during the exploratory trenching activities:

- TRN01 soil samples analyzed for metals, SVOCs (including PAHs), pesticides, PCBs, and PCDD/PCDF
- TRN02 soil samples analyzed for metals, SVOCs (including PAHs), pesticides, and PCBs
- TRN03 soil samples analyzed for metals, SVOCs (including PAHs), pesticides, and PCDD/PCDF
- TRN04 soil samples analyzed for metals, SVOCs (including PAHs), and pesticides
- TRN05 soil samples analyzed for PCBs, SVOCs (including PAHs), pesticides, Ra-226, and Ra-228.

Table B-1 summarizes the analytical parameters evaluated for each soil sample collected during the exploratory trenching in the landfill and all of the sampling locations are shown in Figure B-10. QA/QC samples were collected in accordance with the SAP and included field duplicates (at a rate of 10% of all samples) as well as MS/MSD samples. Equipment rinsate blanks were also collected at the end of each day when exploratory trenching was performed. No IDW was generated that required removal from the site.

5.4 Tissue Sampling

During the wet season sampling event, various types of invertebrates and plants were collected from the landfill during the week of March 14, 2005, to support the ecological risk assessment. An effort was also made to collect small mammal tissue from the landfill; however, these sampling efforts were unsuccessful and no mammal tissue was submitted for chemical analysis. Two memoranda (dated March 28 and May 3, 2005 and provided in Attachment 6) were prepared by the Navy and forwarded to the regulatory agencies describing the tissue sampling efforts. In general, sufficient plant tissue to constitute an individual sample for chemical analysis was collected from each of 10 sampling locations in the landfill of IR Site 2. Limited terrestrial invertebrate tissue volume was collected from the landfill portion of IR Site 2; however, there was insufficient volume to constitute individual samples for chemical analysis at each of the sampling locations. Only one (1) field mouse was collected during the sampling activities at IR Site 2, despite reasonable efforts to collect these tissue types. The following subsections provide additional details related to the sampling and analysis of tissue sampling that was performed in the landfill/interior margin area.

5.4.1 Plants

Plant tissue samples were collected from 10 landfill (upland) locations at IR Site 2 to support the ecological risk assessment, as depicted in Figure B-11. The sampling locations were based on a preliminary review of the dry season surface soil data, and were chosen to provide tissues data from areas exhibiting chemical concentrations that were low, moderate and high relative to concentrations measured across the entire site. Table B-2 summarizes the locations where plant tissues were collected, the type of plants collected at each location, and the chemical analyses that were performed. Field personnel attempted to collect two plant species per site, with one single species representing a unique sample; however, some plants were difficult to identify in the field, hence all samples are not necessarily made up of one unique species. In general, grass tissue samples were chosen for upland locations due to their general ubiquity

Figure B-11. IR Site 2 RI Tissue Sample Locations

Table B-2. Summary of Tissue Sample Locations and Analytical Information at Alameda IR Site 2 and CCSP

Media Type	Station ID	Northing	Easting	Location	Sample Description	Species/Media	Depurated or Nondepurated?	Chemicals (Lab Method)					Physicochemical
								PCBs (BDO SOP 5-128)	Pesticides (BDO SOP 5-128)	SVOCs (8270C)	PAHs (8270C SIM)	Metals (200.8; 6010B; 7062; 7470A; 7742; 1631E)	Lipids
Plant Tissue	SOC01	474363.155	1471498.982	Landfill	SOC01	Grass	NA	x	x	x	x	x	x
	SOC07	473861.078	1472680.891	Landfill	SOC07	Grass	NA	x	x	x	x	x	x
	SOC39	471972.184	1472456.497	Landfill	SOC39	Grass and Larger	NA	x	x	x	x	x	x
	SOC36	472472.028	1472549.665	Landfill	SOC36	Grass	NA	x	x		x	x	x
	SOC28	473045.585	1472722.941	Landfill	SOC28	Grass	NA	x	x	x	x	x	x
	SOC26	473213.152	1472504.985	Landfill	SOC26	Grass	NA	x	x		x	x	x
	SOC20	473536.962	1472410.593	Landfill	SOC20	Grass	NA	x	x	x	x	x	x
	SOC19	473509.257	1472099.101	Landfill	SOC19	Grass	NA	x	x	x	x	x	x
	SOC15	473729.325	1471605.666	Landfill	SOC15	Grass like plant	NA	x	x	x	x	x	x
	SOC17	473584.134	1471336.194	Landfill	SOC17	Grass	NA	x	x	x	x	x	x
	SOC55	472506.449	1472139.913	Wetland	SOC55	Grass	NA	x	x	x	x	x	x
	SOC43	473046.817	1471718.921	Wetland	SOC43	Grass	NA	x	x	x	x	x	x
	SOC42	473261.891	1471604.31	Wetland	SOC42	Grass and seeds	NA	x	x	x	x	x	x
	SOC41	473327.294	1471204.398	Wetland	SOC41	Grass	NA	x	x	x	x	x	x
	SOG02	473313.346	1471364.266	Wetland	SOG02	Salicornia virginica	NA	x	x	x	x	x	x
	SOC41	473327.294	1471204.398	Wetland	SOC41	Salicornia virginica	NA	x	x	x	x	x	x
	SOG10	472988.713	1471098.78	Wetland	SOG10	Salicornia virginica	NA	x	x	x	x	x	x
	SOC47	472348.928	1471095.485	Wetland	SOC47	Grass	NA	x	x		x	x	x
	SOC51	471932.358	1471118.669	Wetland	SOC51	Grass	NA	x	x	x	x	x	x
	SOG19	472333.09	1471631.34	Wetland	SOG19	Grass	NA	x	x		x	x	x
	SOC50	472482.515	1471826.129	Wetland	SOC50	Grass	NA	x	x	x	x	x	x
	SOC117	555355.022	1427863.01	CCSP Upland	SOC117	Grass	NA	x	x	x	x	x	x
	SOC118	554970.237	1428936.37	CCSP Upland	SOC118	Grass	NA	x	x	x	x	x	x
	SOC120	554864.373	1429388.496	CCSP Upland	SOC120	Grass	NA	x	x	x	x	x	x
	SOC122	555608.287	1427845.779	CCSP Wetland	SOC122	Salicornia virginica	NA	x	x	x	x	x	x
	SOC123	555012.997	1428931.07	CCSP Wetland	SOC123	Salicornia virginica	NA	x	x	x	x	x	x
	SOC125	554920.351	1429457.466	CCSP Wetland	SOC125	Salicornia virginica	NA	x	x	x	x	x	x
Clam Tissue	SED07	473201.779	1471220.993	North Pond	SED07-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED08	473089.868	1471419.522	North Pond	SED08-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED09	473159.111	1471591.96	North Pond	SED09-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED10	472965.91	1471307.723	North Pond	SED10-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED11	472999.074	1471656.781	North Pond	SED11-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED12	472853.087	1471671.346	North Pond	SED12-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED07	473201.779	1471220.993	North Pond	SED07-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SED08	473089.868	1471419.522	North Pond	SED08-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED09	473159.111	1471591.96	North Pond	SED09-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED10	472965.91	1471307.723	North Pond	SED10-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SED11	472999.074	1471656.781	North Pond	SED11-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SED12	472853.087	1471671.346	North Pond	SED12-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SED13	472600.375	1471367.72	South Pond	SED13-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED14	472415.945	1471471.041	South Pond	SED14-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED15	472587.11	1471750.903	South Pond	SED15-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED17	472135.854	1471792.278	South Pond	SED17-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED18	472031.726	1471562.07	South Pond	SED18-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED13	472600.375	1471367.72	South Pond	SED13-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED14	472415.945	1471471.041	South Pond	SED14-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED15	472587.11	1471750.903	South Pond	SED15-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SED17	472135.854	1471792.278	South Pond	SED17-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED18	472031.726	1471562.07	South Pond	SED18-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x

Table B-2. Summary of Tissue Sample Locations and Analytical Information at Alameda IR Site 2 and CCSP (page 2 of 2)

								Chemicals (Lab Method)					Physicochemical
Media Type	Station ID	Northing	Easting	Location	Sample Description	Species/Media	Depurated or Nondepurated?	PCBs (BDO SOP 5-128)	Pesticides (BDO SOP 5-128)	SVOCs (8270C)	PAHs (8270C SIM)	Metals (200.8; 6010B: 7062; 7470A; 7742; 1631E)	Lipids
Clam Tissue	SED19	554741.331	1428313.555	China Camp (ditch)	SED19-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED20	553072.703	1434465.104	China Camp (pond)	SED20-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED21	553059.878	1434523.213	China Camp (pond)	SED21-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED22	555252.077	1428797.746	China Camp (offshore)	SED22-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SED23	555397.501	1429056.024	China Camp (offshore)	SED23-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SED19	554741.331	1428313.555	China Camp (ditch)	SED19-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SED20	553072.703	1434465.104	China Camp (pond)	SED20-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED21	553059.878	1434523.213	China Camp (pond)	SED21-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x	x	x	x
	SED22	555252.077	1428797.746	China Camp (offshore)	SED22-Mn-ND	*Macoma nasuta*	Nondepurated	x	x			x	
	SED23	555397.501	1429056.024	China Camp (offshore)	SED23-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SOC122	555608.287	1427845.779	China Camp Wetland Soil	SOC122-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SOC123	555012.997	1428931.07	China Camp Wetland Soil	SOC123-Mn-D	*Macoma nasuta*	Depurated	x	x	x	x	x	x
	SOC125	554920.351	1429457.466	China Camp Wetland Soil	SOC125-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SOC122	555608.287	1427845.779	China Camp Wetland Soil	SOC122-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SOC123	555012.997	1428931.07	China Camp Wetland Soil	SOC123-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SOC125	554920.351	1429457.466	China Camp Wetland Soil	SOC125-Mn-ND	*Macoma nasuta*	Nondepurated	x	x	x		x	x
	SOC42	473265.521	1471601.646	Site IR-2 Wetland Soil	SOC42-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SOC48	472134.276	1471194.047	Site IR-2 Wetland Soil	SOC48-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SOC50	472487.468	1471825.608	Site IR-2 Wetland Soil	SOC50-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SOG11	472499.789	1471039.14	Site IR-2 Wetland Soil+D3	SOG11-Mn-D	*Macoma nasuta*	Depurated	x	x	x		x	x
	SOC50	472487.468	1471825.608	Site IR-2 Wetland Soil	SOC50-Mn-ND	*Macoma nasuta*	Nondepurated	x	x			x	
	NA			Background	Background/Control	*Macoma nasuta*		x	x	x		x	x
	NA			Background	Background/Control	*Macoma nasuta*		x	x	x		x	x
	NA			Background	Background/Control	*Macoma nasuta*		x	x	x	x	x	x
Worm Tissue	SED07	473201.779	1471220.993	North Pond	SED07-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED08	473089.868	1471419.522	North Pond	SED08-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED09	473159.111	1471591.96	North Pond	SED09-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED10	472965.91	1471307.723	North Pond	SED10-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED11	472999.074	1471656.781	North Pond	SED11-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED12	472853.087	1471671.346	North Pond	SED12-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED13	472600.375	1471367.72	South Pond	SED13-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED14	472415.945	1471471.041	South Pond	SED14-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED17	472135.854	1471792.278	South Pond	SED17-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED18	472031.726	1471562.07	South Pond	SED18-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED19	554741.331	1428313.555	China Camp (ditch)	SED19-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED20	553072.703	1434465.104	China Camp (pond)	SED20-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
Worm Tissue	SED21	553059.878	1434523.213	China Camp (pond)	SED21-Nc-D	*Nephtys caecoides*	Depurated					x	
	SED22	555252.077	1428797.746	China Camp (offshore)	SED22-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SED23	555397.501	1429056.024	China Camp (offshore)	SED23-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOC122	555608.287	1427845.779	China Camp Wetland Soil	SOC122-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOC123	555012.997	1428931.07	China Camp Wetland Soil	SOC123-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOC125	554920.351	1429457.466	China Camp Wetland Soil	SOC125-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOC42	473265.521	1471601.646	Site IR-2 Wetland Soil	SOC42-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOC48	472134.276	1471194.047	Site IR-2 Wetland Soil	SOC48-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOC50	472487.468	1471825.608	Site IR-2 Wetland Soil	SOC50-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	SOG11	472499.789	1471039.14	Site IR-2 Wetland Soil	SOG11-Nc-D	*Nephtys caecoides*	Depurated	x	x			x	
	NA			Background	Background/Control	*Nephtys caecoides*	Depurated	x	x			x	x

PCBs = Polychlorinated Biphenyls SVOCs = Semivolatile Organic Compounds PAHs = Polyaromatic Hydrocarbons within the landfill (upland) at IR Site 2, the history of use in food web models based on consumption, and use patterns of local fauna. Some thistle and small bushes were also sampled at the landfill, but these plant types were not sent for chemical analysis because they are not as representative of actual exposures through food web models as grasses would be in the upland area of the site.

All plant samples were collected in accordance with protocols outlined in the project SAP. Plant samples were collected from the landfill by using stainless steel scissors to cut the required plant volume at each sampling location and placing it into a zip-closure polyethylene bags. Field personnel wore clean nitrile gloves and decontaminated all sampling materials between each sampling location. The plant tissue sampling log sheets can be found in Attachment 4-10. All plant samples were frozen until the sampling team was able to confer with the ERA team and decide which samples would be most representative and useful for the risk assessment. At that time, all samples were shipped under chain of custody to CAS in Kelso, WA for processing and chemical analysis. The following list summarizes the analyses that were completed on plant samples that were collected from the landfill in March 2005:

- Analysis of PCBs, pesticides, metals, and SVOCs was completed on all plant tissue samples.

5.4.2 Invertebrates

Terrestrial invertebrate traps were placed at the same 10 locations that were sampled for plants within in landfill at IR Site (see Figure B-11). Invertebrate traps consisted of polyethylene-lined, one-gallon cans that were buried beneath the soil surface, with the top of the can being flush with the ground surface. Three cans were buried at each of the sampling locations, totaling 30 traps within the landfill. On the morning of March 15, 2005, traps were baited with hamburger, peanut butter, oats, and fruit, and the rims were coated with Vaseline® to prevent invertebrates from escaping the traps. One-half inch thick plywood was placed on top of the cans and propped above the lids using dirt and vegetation to provide a dark and damp place for the invertebrates to collect. On the afternoon of March 15 and the 4 subsequent days, the invertebrate traps were checked by field personnel. Field personnel donned clean nitrile gloves to remove the invertebrates from the traps, and placed the catch into zip-closure polyethylene bags. After 5 days of servicing the traps, they were removed from the site and the invertebrates were counted and weighed. A total of 45 individual invertebrates were collected from the landfill, summing to 20 g. The invertebrate tissue sampling log sheets can be found in Attachment 4-11. Approximately 70 g of tissue were needed to perform laboratory analyses for PCBs, pesticides, SVOCs, and metals; therefore, even if all invertebrate tissues collected from the landfill were combined into a composite sample, there was insufficient mass to request the full suite of analyses. Considering chemical data from a composite sample of invertebrate tissues would not be very useful for the ERA, it was decided that chemical analysis of the invertebrate tissues would not be done.

5.4.3 Small Mammals

H.B. Sherman collapsible aluminum traps were placed at the same 10 locations that were sampled for plants and terrestrial invertebrates at the IR Site 2 landfill (see Figure B-11) to trap small mammals. Like the invertebrate traps, three small mammal traps were placed at each of the 10 sampling locations, totaling to 30 traps in the landfill. On the afternoon of March 14, 2005, the small mammal traps were set with bait consisting of peanut butter rolled in dry oatmeal and left overnight. The following morning each of the traps were checked by the field team (which consisted of a person with a take permit issued by USFWS), and if any small mammals were found, they were removed and euthanized. The traps were left unset during the day to preclude capture during daylight hours because the small mammals would likely die from extreme heat inside the trap, and then the traps were reset each evening and rechecked each morning. This cycle continued for four days, meaning 120 traps were checked in the landfill over a four-day period, and only one house mouse (*Mus musulus*) weighing approximately 12 g was trapped. This lone small mammal provided insufficient tissue volume for any meaningful analysis that would help support the ERA; therefore, no small mammal analysis was done.

6.0: WETLAND AND WETLAND POND WET SEASON SAMPLING

Based on a preliminary review of field observations and analytical data collected during dry season (October 2004) sampling activities, no additional soil or groundwater sampling was required in the wetland area of IR Site 2 during wet season sampling activities. There was however additional sediment and surface water sampling performed, and plant, small mammal and invertebrate tissue sampling was attempted in inundated and non-inundated portions of the wetland at IR Site 2 in March 2005 because ecological resources were more abundant and organism populations/communities more representative compared to the dry season. The following subsections describe the wetland sampling activities that were conducted in March 2005.

6.1 Sediment Sampling

A total of 12 surface sediment samples were collected from discrete locations in the North Pond and South Pond during the wet season sampling event on March 12 and 14, 2005, as depicted in Figure B-8. Unlike the dry season sediment sampling, the wet season sediment sampling focused on the surface sediments beneath the water column of the wetland ponds, with the sediment sampling locations coinciding with surface water sampling locations. Sediment sampling was completed after surface water sampling to minimize potential effects to the surface water from sediment sampling activities.

A total of 6 surface sediment samples were collected from the North Pond (SED07-SED12) and 6 were collected from the South Pond (SED13-SED18) using two separate sampling techniques: a 0.04-m^2 modified stainless steel van Veen sampler was used for soft sediment, and a stainless steel spoon and bowl was used for stiff clay sediments that were impenetrable with the grab sampler. Pond water was gently decanted off the surface of the grab sampler or bowl, and the sediment was collected in a clean, 5-gallon bucket where it was homogenized using pre-cleaned stainless steel spoons. The sediments were screened for organic vapors and radiation using a PID and Ludlum Model 3 survey meter, respectively. The findings from the field screening indicated that neither organic vapors nor radiation were detected above background levels in the field for all sediment sampling locations in the wetland ponds. The type of sediment material (e.g., clay or sand) and other pertinent observations (e.g., odor or color) were recorded on the sediment sampling logs which are provided in Attachment 4-12. In general, the most common lithology observed in the surface sediments from the North Pond consisted of a soft black cohesive clay, and in the South Pond, the sediments consisted mostly of black silty sand or a black clayey silt. All South Pond samples exhibited root traces and organic matter while North Pond samples did not. Slight to moderate H_2S odors were observed in both North and South Pond sediment samples. All sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. NAD 27 coordinates for all wet season sediment sampling locations (SED07-SED18) and the discrete depth intervals sampled at each location are provided in Table B-1.

After the sediments were characterized, VOC samples were collected immediately using Encore® samplers and then all other sampling containers were filled. All sediment samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody to CAS for processing and chemical analysis. All of the analyses that were completed on surface sediment samples collected in the wet season from the wetland ponds are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs), TOC, interstitial salinity, grain-size distribution, and sulfides was completed on all sediment samples.

- Analysis of hexavalent chromium and TPH was completed on approximately 50% of all sediment samples from each pond, with samples selected from locations corresponding to surface water samples collected for these parameters.

- Analysis of radionuclides was completed on approximately 33% of all sediment samples from each pond, with samples selected from locations corresponding to surface water samples collected for these parameters.

- Analysis of toxicity endpoints (one species for acute; two species for bioaccumulation) was completed on all sediment samples as discussed in Section 6.4)

Table B-1 summarizes the analytical parameters evaluated for each surface sediment sample collected during the wet season from the wetland ponds. QA/QC samples were collected in accordance with the SAP and included field duplicates (at a rate of 10% of all samples) as well as MS/MSD samples. Equipment rinsate blanks were also collected at the end of each day during which sampling was performed in the field. No IDW was produced from the sediment coring activities in the wet season.

6.2 Surface Water Sampling

Another round of surface water sampling was performed at the wetland ponds to identify potential contamination and to assess the seasonal changes in surface water quality. On March 11 and 12, 2005, surface water samples were collected from the same locations that were sampled in October 2004. A total of 6 locations were sampled for surface water in the North Pond (SWA01 to SWA06) and 6 locations were sampled for surface water in the South Pond (SWA07 to SWA12), as depicted in Figure B-9. Note that surface water samples were collected from locations SWA07 and SWA08 in March 2005, even though these areas were dry in October 2004. In general, the North Pond and South Pond were not as shallow and dry as they were in October 2004. Water depths at sampling locations in the North Pond were approximately 2 ft, and between 3 and 5 ft in the South Pond. All SWA locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit. The NAD 27 coordinates for all wet season wetland pond surface water sampling locations are tabulated in Table B-1.

At each wet season surface water sampling location, pH, conductivity, and salinity were measured and recorded using a YSI 6600 EDS multi-parameter water quality meter. Sampling was performed by submerging one pre-cleaned container under the water surface, filling it up, and using it to fill all of the required sampling containers. This procedure was followed rather than submerging each of the sampling containers themselves because some sampling containers contained acid preservative. After each sample container was filled, the cap was replaced and tightened, and the containers were placed in a cooler with ice.

All surface water samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody directly to the appropriate contracted analytical laboratories for chemical analysis. All of the analyses that were completed on surface water samples collected from the wetland ponds in the wet season were the same as those collected in the dry season, and are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs and 1,4-dioxane), alkalinity, and hardness was completed on all surface water samples.

- Analysis of hexavalent chromium and TPH was completed on approximately 50% of all surface water samples from each pond, with samples selected randomly.

- Analysis of radionuclides (gross alpha, gross beta, Ra-226, Ra-228, Pb-210, and isotopic uranium) was completed on approximately 33% of all surface water samples from each pond, with samples selected randomly.

- Analysis of acute and chronic toxicity using two species as described in Section 6.4.

Two sets of surface water samples were collected at each sampling location. One was analyzed unfiltered and the second was filtered at the laboratory prior to analysis. Table B-1 provides a detailed list of the analytical parameters evaluated for each surface water sample collected during the wet season from the wetland ponds. QA/QC samples were collected and included field duplicates (at a rate of 10% of all samples) and MS/MSD samples. Equipment rinsate blanks were collected at the end of each work day that surface water sampling was performed. Copies of surface water purging and sampling logs for the wet season wetland pond sampling stations are presented in Attachment 4-13.

6.3 Tissue Sampling

During the wet season sampling event, various types of terrestrial invertebrates and plants were collected from the wetland during the week of March 14, 2005, to support the ERA. An effort was also made to collect small mammal tissue from the non-inundated portions of the wetland and fish and benthic invertebrates from the wetland ponds; however, these sampling efforts were unsuccessful and no mammal tissue or fish and benthic invertebrate tissues were submitted for chemical analysis. Two memoranda (dated March 28 and May 3, 2005 and provided in Attachment 6) were prepared by the Navy and forwarded to the regulatory agencies describing the tissue sampling efforts. In general, sufficient plant tissue volume to constitute an individual sample for chemical analysis was collected from each of 12 sampling locations in the wetland of IR Site 2. Limited terrestrial invertebrate tissue volume was collected from the wetland; however, there was insufficient volume to constitute individual samples for chemical analysis at each of the sampling locations. No small mammals, benthic invertebrates or fish were collected from the wetland during the sampling activities at IR Site 2, despite reasonable efforts to collect these tissue types. The following subsections provide additional details related to the sampling and analysis of tissue sampling that was performed in the wetland area.

6.3.1 Plants

Plant tissue samples were collected from 12 wetland locations at IR Site 2 to support the ecological risk assessment, as depicted in Figure B-11. Table B-2 summarizes the locations where plant tissues were collected, the type of plants collected at each location, and the chemical analyses that were performed. In general, Pickleweed *(Salicornia virginica)* samples were chosen from wetland locations due to their general ubiquity within the wetland at IR Site 2, the history of use in food web models based on consumption, and use patterns of local fauna. At one location (SOC41) both grasses and pickleweed were collected and analyzed, and at two locations (SOC48 and SOG11), only *Carpobrotus sp.* (ice plant) was found. Ice plant samples were not be sent for chemical analysis because this plant was not considered to represent a significant portion of the diet of any of the wetland receptors being evaluated in the ERA.

All plant samples were collected in accordance with protocols outlined in the project SAP. Plant samples were collected from the wetland using the same procedure that was used in the landfill and described in Section 5.4.1. The plant tissue sampling log sheets can be found in Attachment 4-14. All plant samples were frozen until the sampling team was able to confer with the ERA team to decide which samples would be most representative and useful for the risk assessment. At that time, all samples were shipped under chain of custody to CAS in Kelso, WA for processing and chemical analysis. The following list summarizes the analyses that were completed on plant samples that were collected from the wetland in March 2005:

- Analysis of PCBs, pesticides, metals, and SVOCs was completed on all plant tissue samples.

6.3.2 Invertebrates

Attempts were made to collect samples of 3 types of invertebrates within the non-inundated and inundated portions (i.e., ponds) of the wetland at IR Site 2: terrestrial, benthic, and other aquatic species. The following subsections discuss these sampling efforts.

6.3.2.1 Terrestrial Invertebrates

Terrestrial invertebrate traps were placed at the same 12 locations that were sampled for plants within wetland at IR Site (see Figure B-11). The invertebrate traps in the wetland are the same as those used in the landfill and are described in Section 5.4.2. Three traps were buried at each sampling location, totaling 36 traps within the landfill. On the morning of March 15, 2005, traps were baited and one-half inch thick plywood was placed on top of the cans and propped above the lids using dirt and vegetation to provide a dark and damp place for the invertebrates to collect. On the afternoon of March 15 and for the four subsequent days, the invertebrate traps were checked by field personnel. Field staff donned clean nitrile gloves to remove the invertebrates from the traps, and placed the catch into zip-closure polyethylene bags. After 5 days of servicing the traps, they were removed from the site and the invertebrates were counted and weighed. A total of 163 individual invertebrates were collected from the wetland, summing to a weight of 49.5 grams. The invertebrate tissue sampling log sheets can be found in Attachment 4-15. Approximately 70 grams of tissue were needed to perform the full suite of laboratory analyses and considering chemical data from a composite sample of invertebrate tissues would not be very useful for the ERA, it was decided that chemical analysis of the invertebrate tissues would not be done.

6.3.2.2 Benthic Invertebrates

Benthic invertebrate sampling was conducted in both wetland ponds at IR Site 2 by collecting and sieving pond sediment. Based on geomorphology (i.e., narrow and long), the South Pond was divided into six "reaches" or stretches of channel. Each reach contained one of the six surface water (SWA) and sediment (SED) stations established in this pond (i.e., SWA07/SED13, SWA08/SED14, SWA09/SED15, SWA10/SED16, SWA11/SED17, and SWA12/SED18 in Figures B-8 and B-9). Two individual locations were sampled in each reach, except for a short reach corresponding to SWA10/SED16 where only one location was sampled. Accordingly, a total of 11 pond benthic invertebrate (PBI) stations were sampled in the South Pond. In the North Pond, PBI stations were co-located with the SWA/SED stations (i.e., SWA01/SED07, SWA02/SED08, SWA03/SED09, SWA04/ SED10, SWA05/SED11, and SWA06/SED12), for a total of 6 stations sampled in this pond.

At each PBI station, three 0.04-m^2 van Veen grab samples of surface sediment were collected. The samples were sieved through 1.0-mm Nytex® (i.e., nylon mesh) screen, and the material retained on the sieve was described and photographed. Material remaining on the sieve was generally plant roots, stems, and other decayed organic matter. No benthic invertebrates were observed in the samples collected from the South Pond. In the North Pond samples, a few very small (<10 mm) worms were observed, but only at sampling location SWA04/SED10. No worms or other invertebrates were found at any of the other North Pond sampling locations. Three separate grabs were completed at SWA04/SED10, and approximately 25 worms were collected. However, the resulting volume of benthic invertebrate tissue was insufficient to support chemical analysis.

6.3.2.3 Other Aquatic Invertebrates

Numerous water column invertebrates (primarily brine shrimp and water boatmen, probably *Trichocorixia reticulata* [Corixidae]) were observed in the water column in the wetland ponds at IR Site 2, particularly in and around the submerged pickleweed (*Salicornia*) at the edges of the ponds. A 0.5-m-diameter plankton tow net was used to collect aquatic invertebrates from the near-surface water column. The plankton net was towed for approximately three minutes in the vicinity of each SWA/SED station in each of the ponds, and the contents of each tow were collected in an unpreserved 16-oz glass jar. It was very difficult to separate the small aquatic invertebrates from debris and algae in the samples, and the volume of aquatic invertebrate tissue was so small that insufficient mass is obtainable for laboratory chemical analysis.

6.3.3 Small Mammals

H.B. Sherman collapsible aluminum traps were placed at the same 12 locations that were sampled for plants and terrestrial invertebrates at the IR Site 2 wetland (see Figure B-11) to trap small mammals. Like the invertebrate traps, three small mammal traps were placed at each of the 12 sampling locations, totaling to 36 traps in the wetland. On the afternoon of March 14, 2005, the small mammal traps were set with bait and left overnight. The following morning each of the traps were checked by the field team (which consisted of a person with a take permit issued by USFWS), and if any small mammals were found, they were removed and euthanized. The traps were left unset during the day to preclude capture during daylight hours because the small mammals would likely die from extreme heat inside the trap, and then the traps were reset each evening and rechecked each morning. This cycle continued for 4 days, meaning 144 traps were checked in the wetland over a 4 day period of time, and no house mice were trapped; therefore, chemical analysis of small mammals from the wetland was not possible.

6.3.4 Fish

Fish sampling was attempted in both wetland ponds at IR Site 2 by seining. A 35-ft beach seine net with 3/8-in mesh was used during the fish sampling efforts in the ponds. Two seines were attempted in each reach in South Pond (i.e., the same reaches as developed for PBI sampling), generally near the six SWA/SED stations. Two seines were attempted near each SWA/SED station in North Pond, except at SWA01/SED07 (described below).

Only plant material, sediment, and filamentous green algae were collected in the seines attempted in the South Pond. Generally, only a small amount of sediment was retained in the net at the North Pond seining locations. However, in the first seine attempted near SWA01/SED07 (i.e., near the culvert [outlet] between North Pond and the bay), one very small fish (<3.5 centimeter [cm]) was observed escaping through the mesh. In response, the field team attempted three more seines around the outlet of the culvert to see if the escaped fish or any other fish could be captured. Ultimately, other than the one small fish observed at SWA01/SED07, no other signs of fish activity were observed during the fish sampling efforts, and no fish were caught in any of the beach seines, which totaled to 12 in the South Pond and 14 in the North Pond. In addition, field personnel did not observe any fish-eating birds (e.g., herons or cormorants) in the ponds during the entire surface water, sediment, and invertebrate sampling effort at IR Site 2. Given that these birds are relatively common around San Francisco Bay, it seems likely they would have been present at IR Site 2 if suitable prey fish were present.

6.4 Bioassay Sampling

Coincident with the collection of surface sediments and surface water obtained from the wetland ponds for chemical analysis, large volumes of these matrices were collected to support toxicity and bioaccumulation testing. In addition, given the limited amount of invertebrate tissue samples that were able to be collected from the wetlands, the sampling team decided to collect 5 wetland soil samples for bioaccumulation testing. Figure B-12 shows the wetland sampling locations according to the type of toxicity/bioaccumulation test conducted at the IR Site 2 wetland. Collection methods for soil, surface sediment, and surface water were as previously discussed in Sections 4.1, 6.1 and 6.2. Bioassay sample log forms are presented in Attachment 4-16. The bioassay sample containers consisted of sediment samples being stored in 20L HDPE buckets and surface water samples being collected in 5L carboys. All bioassay samples were shipped to the Battelle Marine Sciences Laboratory in Sequim, WA.

Figure B-12. IR Site 2 RI Bioassay Sample Locations

7.0: REFERENCE AND BACKGROUND SAMPLING

Some sampling was performed to augment existing background/reference datasets that are to be used in the IR Site 2 RI Report. Reference soil samples were collected from the same areas at Alameda Point that were used to establish Ra-226 background levels during radiological surveying activities of 2004 (TTFW, 2005), and analyzed for PCDD/PCDF analysis. In addition, soil, sediment, surface water, plant tissue and invertebrate tissue sampling was performed at China Camp State Park, which is a reference site that was described in a Navy memorandum dated November 19, 2004 (see Attachment 7), and agreed to be generally representative of reference conditions by the regulatory agencies prior to the RI sampling activities. The following subsections describe the Alameda Point and CCSP reference sampling activities in greater detail.

7.1 Alameda Reference Sampling

A total of 6 reference soil samples were collected on March 9, 2005 from three separate areas at Alameda Point to generate background data for PCDD/PCDF. The locations sampled are shown on Figure B-13 and correspond to the same areas that were sampled to establish Ra-226 background during radiological surveying activities conducted in 2004 (Battelle et al., 2005). A total of 5 surface soil grab samples were collected at each reference area using a stainless steel hand trowel, and 2 samples from each area were chosen for PCDD/PCDF analysis. At each sampling location, the upper 2 to 3 inches, which consisted of sod, was removed and underlying soils were collected into a stainless steel bowl. Once sufficient volume was collected, the soil was homogenized using the trowel and then screened for volatile organic vapors and radiation using a PID and Ludlum Model 3 survey meter, respectively. No organic vapors or radiation was measured above background levels. All samples were placed into laboratory-provided sample glassware and shipped under chain of custody to CAS for PCDD/PCDF analysis.

Both the hand trowel and mixing bowl were decontaminated between sampling locations according to procedures in the project SAP (Battelle et al., 2005) and the location of each sampling station was surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit.

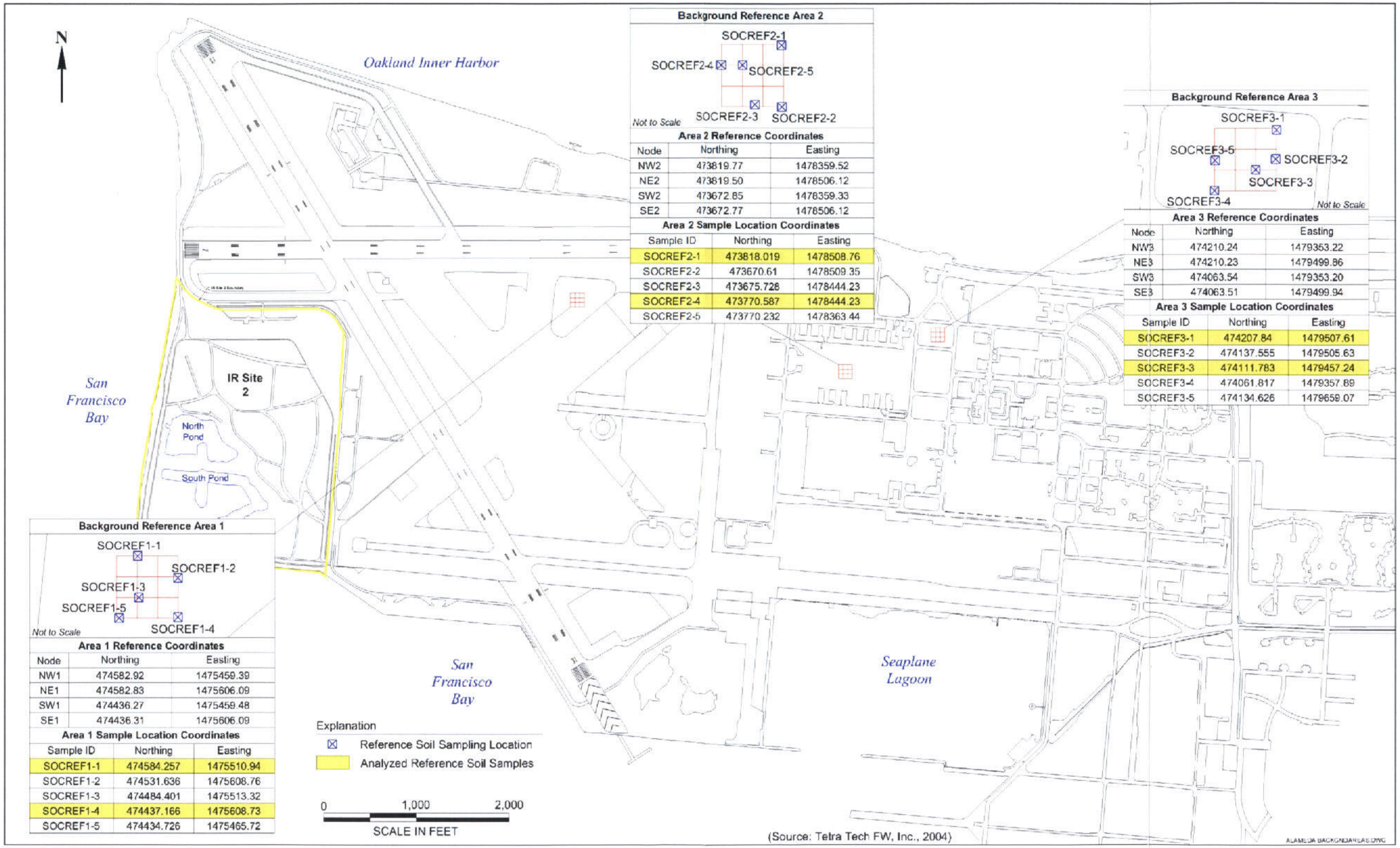
Following sample collection, very minimal amounts of residual soil were containerized in a labeled 55-gallon drum and maintained as IDW. Decontamination waste water was also drummed as IDW in a separate labeled 55-gallon drum. Due to the very shallow depth of the surface soil sampling locations, no boring logs were generated. Also, no specific borehole abandonment protocols were required. Instead, the removed sod layer was returned to the sampling location.

7.2 China Camp State Park Reference Sampling

Soil, sediment, surface water, plant tissue and invertebrate tissue sampling was performed at CCSP to augment existing background/reference datasets. Benthic invertebrate and fish tissue sampling was not conducted at CCSP due to the lack of these tissues at the IR Site 2 wetland ponds. Also, the terrestrial invertebrate samples that were collected from CCSP were not submitted for chemical analysis because the same type of sample was not submitted for chemical analysis from IR Site 2. These sampling activities are described below.

7.2.1 Soil Sampling

On March 18, 2005 a total of 6 soil samples were collected from CCSP (SOC117, SOC118, SOC120, SOC122, SOC123, and SOC125 as depicted in Figures B-14 and B-15) using the same procedures that were used to collected reference samples from Alameda Point. At each location a pre-cleaned stainless steel trowel was used to collect the required volume of soil into a stainless steel bowl, before it was trans



Area 1 Reference Coordinates

Node	Northing	Easting
NW1	474582.92	1475459.39
NE1	474582.83	1475606.09
SW1	474436.27	1475459.48
SE1	474436.31	1475606.09

Area 1 Sample Location Coordinates

Sample ID	Northing	Easting
SOCREF1-1	474584.257	1475510.94
SOCREF1-2	474531.636	1475608.76
SOCREF1-3	474484.401	1475513.32
SOCREF1-4	474437.166	1475608.73
SOCREF1-5	474434.726	1475465.72

Area 2 Reference Coordinates

Node	Northing	Easting
NW2	473819.77	1478359.52
NE2	473819.50	1478506.12
SW2	473672.85	1478359.33
SE2	473672.77	1478506.12

Area 2 Sample Location Coordinates

Sample ID	Northing	Easting
SOCREF2-1	473818.019	1478508.76
SOCREF2-2	473670.61	1478509.35
SOCREF2-3	473675.728	1478444.23
SOCREF2-4	473770.587	1478444.23
SOCREF2-5	473770.232	1478363.44

Area 3 Reference Coordinates

Node	Northing	Easting
NW3	474210.24	1479353.22
NE3	474210.23	1479499.86
SW3	474063.54	1479353.20
SE3	474063.51	1479499.94

Area 3 Sample Location Coordinates

Sample ID	Northing	Easting
SOCREF3-1	474207.84	1479507.61
SOCREF3-2	474137.555	1479505.63
SOCREF3-3	474111.783	1479457.24
SOCREF3-4	474061.817	1479357.89
SOCREF3-5	474134.626	1479659.07

Figure B-13. Alameda Point Reference Soil Sample Locations.

ferred to laboratory-provided glassware. The soil material was classified and other observations such as color and odor were recorded on the soil sampling log provided in Attachment 4-17. All soil sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit and all of the NAD 27 coordinates for each location are provided in Table B-1.

All soil samples were collected in accordance with protocols outlined in the project sampling and analysis plan (SAP) and shipped under chain of custody to CAS in Kelso, WA for processing and chemical analysis. All soil samples collected from CCSP were analyzed for PCBs, pesticides, metals, VOCs, SVOCs (including PAHs) and moisture content. Table B-1 provides a comprehensive list of all chemical analyses performed on the CCSP soil samples.

7.2.2 Sediment Sampling

A total of 5 surface sediment samples (SED19-SED23) were collected from CCSP on March 11, 2005. Two areas in CCSP were sampled to produce the five samples (see Figure B-14). CCSP sediments were collected using the same procedures that were used to collect surface sediment from the IR Site 2 wetland ponds as described in Section 6.1. The type of sediment material (e.g., clay or sand) and other pertinent observations (e.g., odor or color) were recorded on the sediment sampling logs which are provided in Attachment 4-18. All sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit and the NAD 27 coordinates for all CCSP sediment sampling locations (SED19-SED23) are provided in Table B-1.

After the sediments were characterized, VOC samples were collected immediately using Encore® samplers and then all other sampling containers were filled. All sediment samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody to CAS for processing and chemical analysis. All of the analyses that were completed on surface sediment samples collected from CCSP are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs), TOC, interstitial salinity, grain-size distribution, sulfides, hexavalent chromium and TPH was completed on all sediment samples.

- Analysis of radionuclides was completed on approximately 40% of all (or 2 of 5) sediment samples from CCSP, with samples selected from locations corresponding to surface water samples collected for these parameters.

- Analysis of toxicity endpoints (one species for acute; two species for bioaccumulation) was completed on all sediment samples as discussed in Section 6.4 (see Figure B-15).

Table B-1 summarizes the analytical parameters evaluated for each surface sediment sample collected during from CCSP. No IDW was produced from the sediment coring activities in the wet season.

7.2.3 Surface Water Sampling

A total of 5 surface water samples were collected from CCSP on March 11, 2005 (see Figures B-14 and B-15) in the same locations as those were surface sediment samples were collected. Surface water samples were collected before the sediments samples to reduce the likelihood that suspended sediments would impact the surface water results. Water depths at the sampling locations ranged from approximately 8 inches and 4.5 ft as identified on the sampling log sheets provided in Attachment 4-19. All

CCSP surface water sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit and the NAD 27 coordinates are tabulated in Table B-2.

At each CCSP surface water sampling location, pH, conductivity, and salinity were measured and recorded using a YSI 6600 EDS multi-parameter water quality meter. Sampling was performed by submerging one pre-cleaned container under the water surface, filling it up, and using it to fill all of the required sampling containers. This procedure was followed rather than submerging each of the sampling containers themselves because some sampling containers contained acid preservative. After each sample container was filled, the cap was replaced and tightened, and the containers were placed in a cooler with ice.

All surface water samples were collected in accordance with protocols outlined in the project SAP and shipped under chain of custody directly to the appropriate contracted analytical laboratories for chemical analysis. All of the analyses that were completed on surface water samples collected from CCSP are summarized as follows:

- Analysis of PCBs, pesticides, metals, VOCs, SVOCs (including PAHs and 1,4-dioxane), alkalinity, hardness, sulfides, hexavalent chromium and TPH was completed on all surface water samples.
- Analysis of radionuclides (gross alpha, gross beta, Ra-226, Ra-228, Pb-210, and isotopic uranium) was completed on approximately 40% of all (or 3 of 5) surface water samples from locations corresponding to sediment samples collected for these parameters.
- Analysis of acute and chronic toxicity using two species (see Figure B-15).

Two sets of surface water samples were collected at each sampling location. One was analyzed unfiltered and the second was filtered at the laboratory prior to analysis. Table B-1 provides a detailed list of the analytical parameters evaluated for each surface water sample collected during the wet season from the wetland ponds.

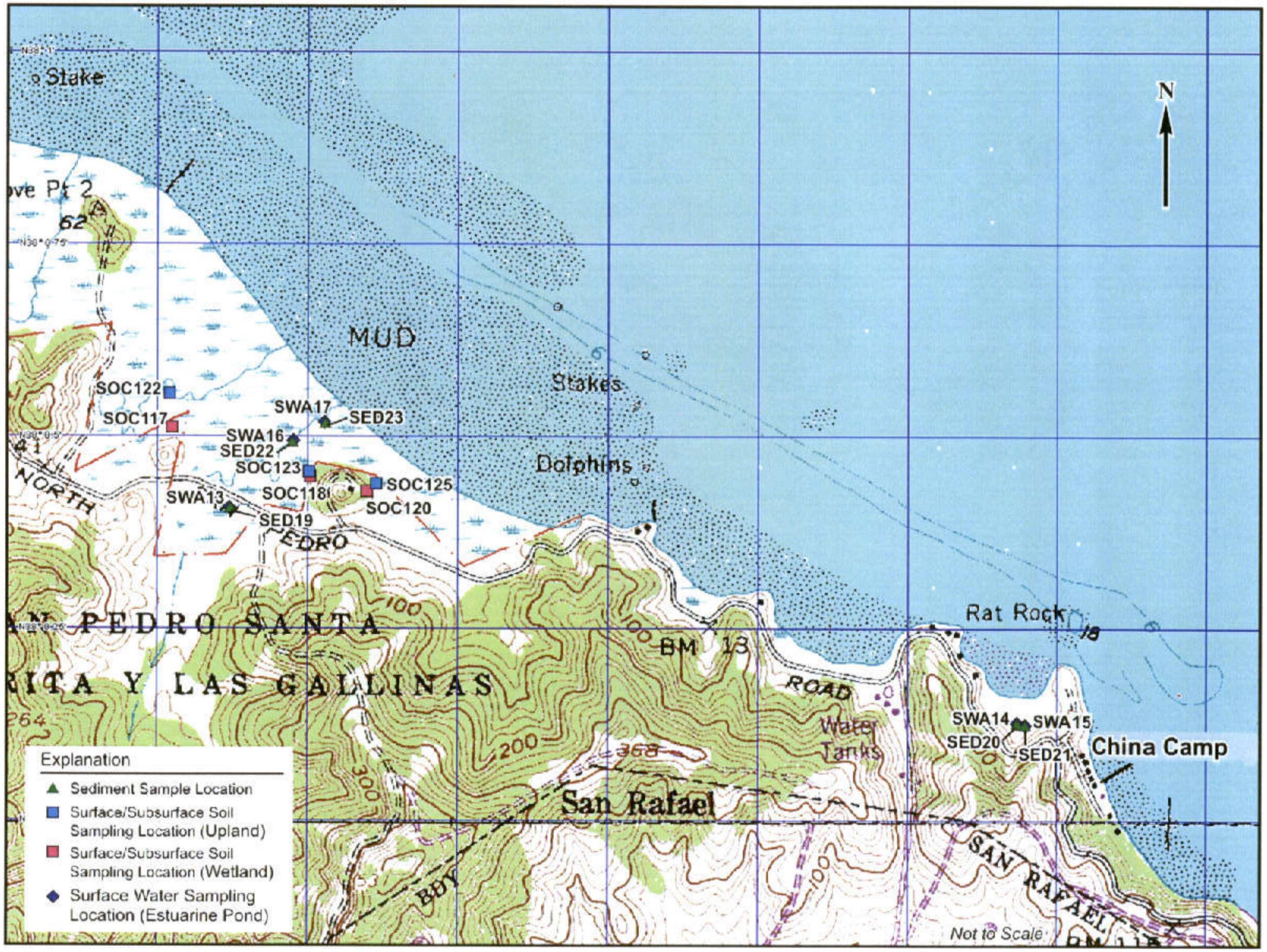


Figure B-14. China Camp State Park Reference Soil, Sediment, and Surface Water Sample Locations

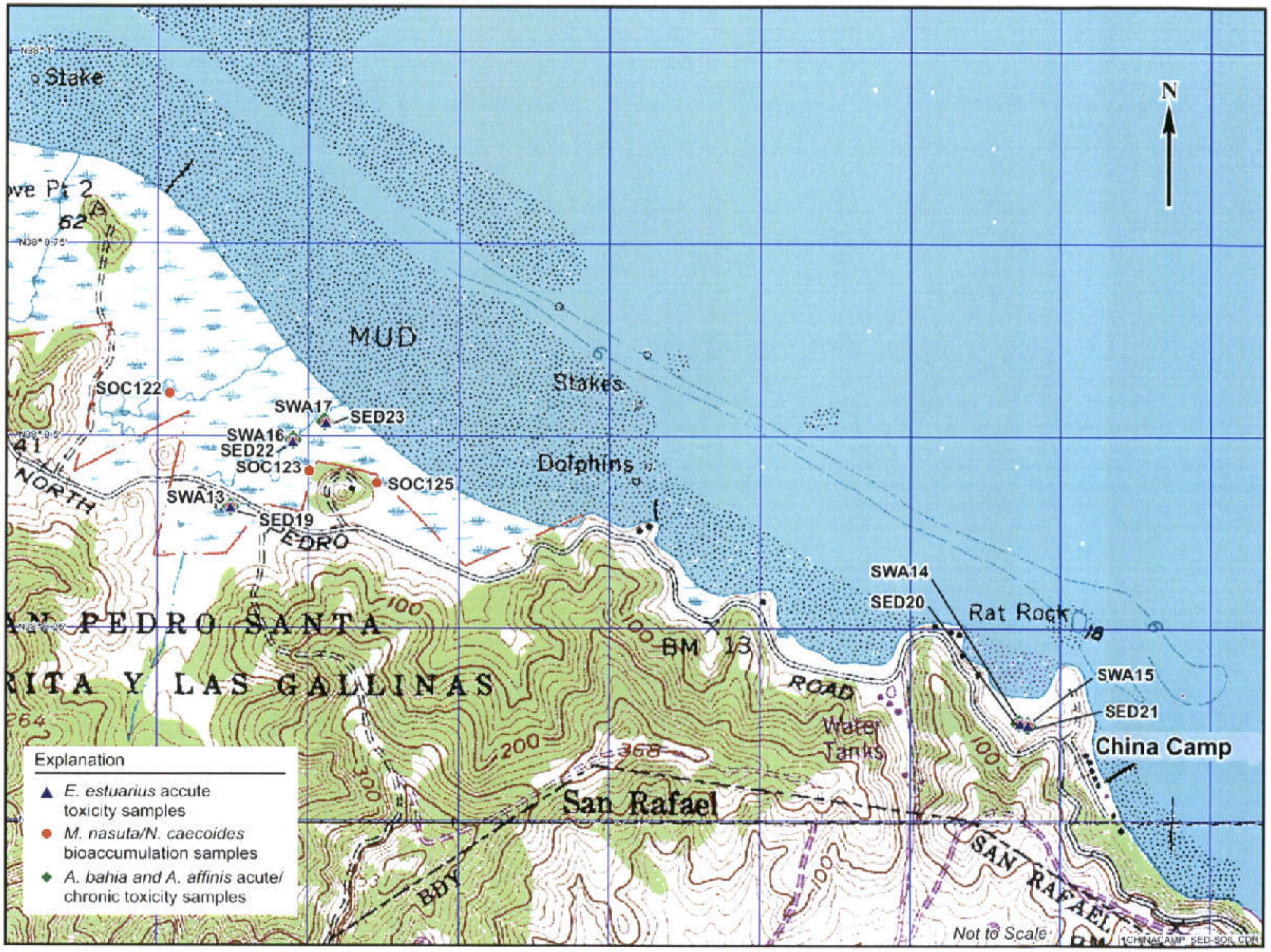


Figure B-15. China Camp State Park Reference Bioassay Sample Locations

8.0: SUMMARY OF PROBLEMS AND DEVIATIONS

Very few problems were encountered during the RI sampling activities that required deviations from the Final RI Sampling Work Plan (Battelle et al., 2005) with the exception of the tissue sampling efforts that were effected by insufficient tissues being available at the site (see description in Section 6.3 and memoranda that are included in Attachment 6). Any other deviations, all of which were minor, were documented in field log books and are summarized below.

As described in Section 2.1, the Navy planned to deploy a total of 4 water quality meters in July 2004; however, shallow water levels in the North Pond precluded both meters being deployed in July. Instead, only one meter was placed in the North Pond in the channel near the culvert connecting the North Pond and the San Francisco Bay and a fourth meter was added on January 26 after rainfall served to sufficiently raise the pond level.

During the continuous water quality monitoring, on several occasions sensors were fouled by sediment or high sulfide concentrations. These problems were corrected during scheduled maintenance operations, but there are some periods of time when suspect data was collected.

8.1 Dry Season Sampling Event

The work plan deviations that were encountered during the RI sampling activities in the dry season (October 2004) are as follows:

- During the preliminary data acquisition phase there were a few portions of the site that could not be accessed for geophysical survey due to impassible terrain. This condition was encountered in the central portion of the wetland, and in the northwestern portion of the interior margin where a stand of trees is located.
- Some soil sampling locations within the IR Site 2 landfill were shifted due to Geoprobe refusal being encountered on subsurface obstructions such as wood and concrete. Typically, the new sample location was only a few feet away from the original proposed location and all of the final sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit.
- In most cases, subsurface soil sampling within the wetlands portion of IR Site 2 was limited to only one sample instead of the proposed two because the depth to groundwater was generally on the order of 2-4 ft bgs.
- A groundwater sample could not be collected from HYP15 because the temporary 1-inch well was dry. Instead, a groundwater sample was collected from a nearby permanent 2-inch well that was unmarked and located approximately 33 ft southeast of the intended location from HYP15. The depth to water and total depth of the unmarked well was checked by the field team and confirmed to be similar to that of the temporary HYP wells.

8.2 Wet Season Sampling Event

The work plan deviations that were encountered during the RI sampling activities in the wet season (March 2005) are as follows:

- Similar to the dry season, some soil sampling locations within the IR Site 2 landfill were shifted due to Geoprobe refusal being encountered on subsurface obstructions such as wood and concrete. Typically, the new sample location was only a few feet away from the original proposed location and all of the final sampling locations were surveyed using a hand-held Trimble Geoexplorer® GeoXT™ GPS unit.

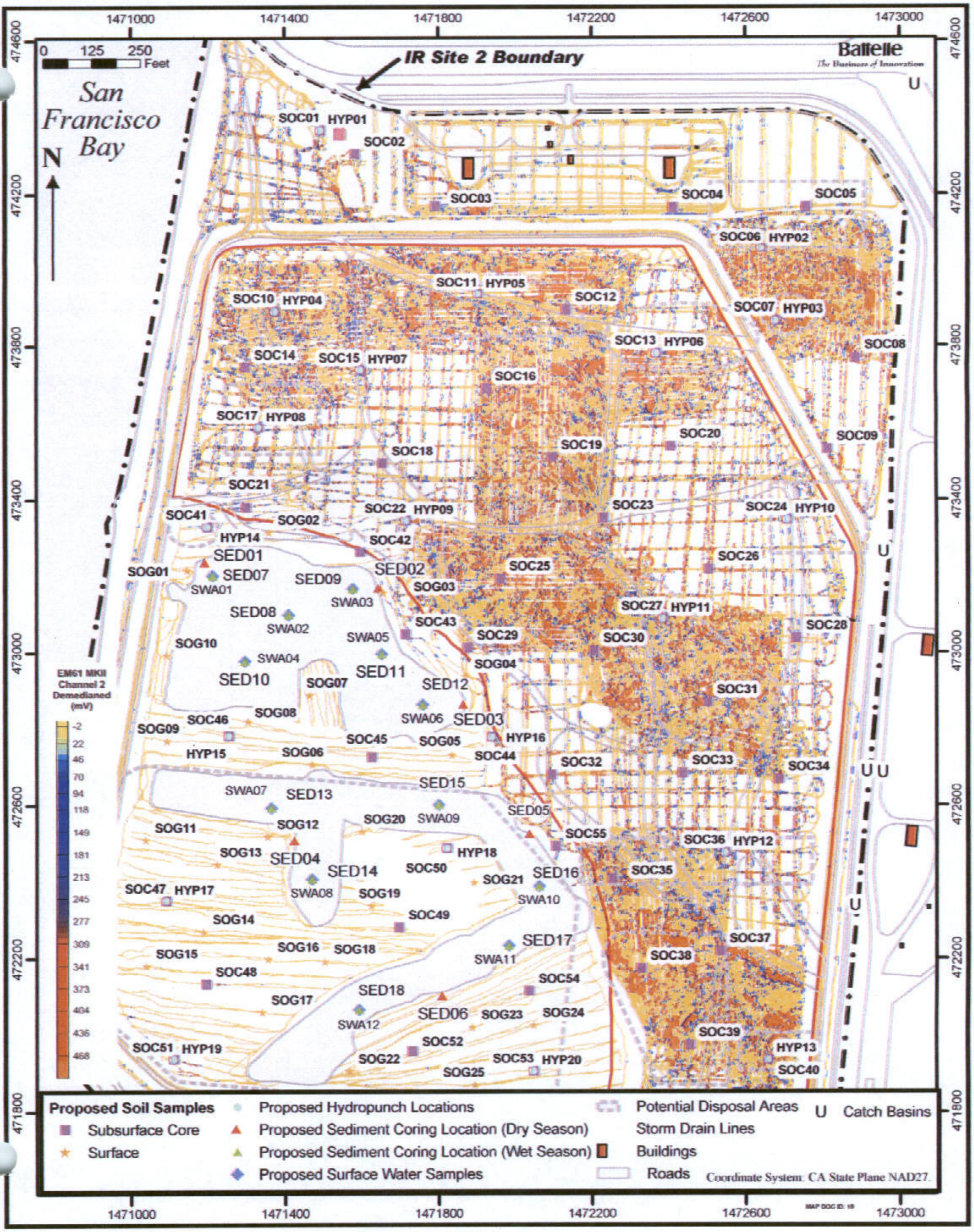
9.0: REFERENCES

Battelle, BBL Inc., and Neptune and Co. 2005. *Final Offshore Sediment Study Work Plan at Oakland Inner Harbor, Pier Area, Todd Shipyard, and Western Bayside, Alameda Point, California.* Prepared for Base Realignment and Closure, Program Management Office West, San Diego, CA. May 27.

Tetra Tech FW, Inc. 2005. *Final Installation Restoration Site 2 Radiological Characterization Survey Report.* Prepared for Base Realignment and Closure, Program Management Office West, San Diego, CA. August 5.

ATTACHMENT 1

PLATE DIAGRAM OF FINAL GEOPHYSICAL SURVEYING RESULTS



IR Site 2 Boundary
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The Business of Innovation
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Proposed Soil Samples
Subsurface Core
Surface
Proposed Hydropunch Locations
Proposed Sediment Coring Location (Dry Season)
Proposed Sediment Coring Location (Wet Season)
Proposed Surface Water Samples
Potential Disposal Areas
Storm Drain Lines
Buildings
Roads
U Catch Basins
Coordinate System: CA State Plane NAD27.
MAP DOC ID: 18

ATTACHMENT 2

FINAL GEOPHYSICAL SURVEYING REPORT ISSUED BY POWER SURVEYING

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December 3, 2004

Travis Williamson
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Columbus, Ohio 43201
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Re: Geophysical Investigation for Landfill Waste Delineation at the Installation Restoration Site 2 (IR Site 2)

Mr. Williamson,

This letter report summarizes the fieldwork and data processing of the digital geophysical mapping (DGM) investigation for buried landfill waste detection conducted by Power Surveying at the West Beach Landfill and Wetlands at NAS Alameda Point in Alameda, California. The Power Surveying fieldwork began on September 15, 2004 and the final data were collected on October 7, 2004. DGM was performed using a Geonics EM61 MKII electromagnetic instrument and positioning was accomplished with a Trimble 5700 Real Time Kinetic (RTK) GPS. The objective of this DGM investigation was to identify the presence and extent of Landfill waste material and potential areas of discrete waste disposal and was the first part of an extensive Remedial Investigation. The DGM results were used to guide locations for subsequent soil and groundwater sampling activities.

FIELD METHODS

Active source electromagnetic (EM) geophysical methods are used to discriminate between conductive and resistive subsurface objects or strata. Eddy currents are induced in the subsurface with a coil source that produces a time-varying magnetic field. The EM61 MKII used in this investigation is a Time Domain Electromagnetic (TDEM) system. The EM61 MKII generates 150 EM pulses per second (frequency of 150 Hz). After each pulse, secondary EM fields (eddy currents) are induced in conductive soils and remain for a longer time in metallic objects. The EM61 MKII measures the field produced by the time-varying eddy currents which induce a current on the instrument's coil. This response is measured in units of millivolts (mV). High amplitude (mV) readings are attributed to the presence of metallic objects.

Accurate positioning is critical for accurate delineation of subsurface targets. DGM data positioning was performed with a Trimble 5700 RTK DGPS. All coordinates were recorded in WGS84 Latitude/Longitude and referenced to a local base station control point that was established in GPS autonomous mode. These coordinates were later projected to the NAD27 California State Plane Zone 3 projected coordinate system.

Two EM61 MKII systems were employed in the field. A single array was used for data collection in the Wetlands area primarily and the Power dual coil towed array system was used for the majority of data collection in the Landfill area. The dual coil system is configured with 2 EM61 MKII coils positioned side by side along the short axis of the coil (0.5 m side). The EM61 MKII systems recorded data continuously at a nominal rate of 5 readings per second (5 Hz). This resulted in data points along survey profiles being spaced nominally at 0.8 ft to 1.2 ft. The GPS recorded data continuously at a nominal rate of 1 reading per second (1 Hz). This resulted in data points along survey lines being spaced nominally 4 - 6 ft.

QUALITY CONTROL PROCEDURES

Standard quality control tests were performed at the Alameda site to ensure quality data were recorded daily. These tests include the cable shake test, static test, and latency test and are standard operating procedures at Power Surveying Company. We perform these measures in accordance with the U.S. Army Corps of Engineers (USACE) requirements for electromagnetic UXO detection work. Table 1 lists the WGS84 geodetic coordinates of the static and latency points and GPS base station.

Table 1 – QC Test Coordinates

Object	Longitude (W)	Latitude (N)
Static Point	122° 19' 47.2186"	037° 47' 23.0384"
Latency Point	122° 19' 47.7464"	037° 47' 23.0218"

The Table 1 static and latency point coordinates were established based on the results of an initial EM survey that was performed to locate anomaly-free areas. This initial survey is performed to ensure that the there are no anomalies near the static or latency points that could corrupt the QC test data. The latency line amplitudes for Channel 2 are presented in Figure A-1 of Appendix A. Figure A-1 also shows the latency and static points locations.

Cable Shake Test

The coils were checked for their response to vibrations in the cables prior to daily data collection. This was done by running the coil in stationary mode and manually shaking the cables. The response of the coils to the cable shake is similar to the coils response when traveling over small bumps or other terrain obstructions. The field operator monitors the output voltage to verify that the cables do not produce any anomalous readings.

Static Test

Each morning and afternoon, static background response and static standard response tests are performed to verify instrument stability, assess noise levels, and determine repeatability. The static test is performed by collecting data at the same location on the ground (see Table 1) for a minimum period of 5 minutes. Background levels are recorded for the first minute, followed by 3 minutes of standard testing, and finally another 1 minute of recording background levels. The standard test consists of placing a steel trailer ball (or other small, symmetrical metallic object) on the ground at the coil's center to simulate instrument response to a buried target. The background response test is performed to ensure instrument stability prior to and after the standard response test and to assess background noise levels. The mean amplitude value for each of 4 channels is calculated. The passing criteria require 95% of the data to lie within a ± 2.5 mV envelope of the mean calculated value for each channel. Figure A-2 presents example static background response results from the morning QC test for System 2 (single coil) on September 22, 2004. The data (green) lie well within the ± 2.5 mV envelope of the mean for each channel (red dashed lines).

The static standard response test is performed to determine instrument repeatability. The mean value for the 3 minute long morning test must be within ± 20% of the mean value for the 3 minute long afternoon test. These statistics are calculated for each of the 4 channels. Example output for System 2 on September 22 is presented in Figure A-3 of Appendix A. The morning test name is L22661S:0 and afternoon test name is L22662S:0. The mean value for each channel for the afternoon test is well within the mean value for each channel for the morning test.

Latency Test

The latency test is performed to assess the value of the combined EM/GPS system latency for the given instrumentation on a given day. A time lag is inherent in the DGM data so that the recorded GPS position for a particular EM reading does not coincide with the true ground position for that reading. System latency is typically constant and can be accounted for. During the latency test, combined EM/GPS data are collected while crossing over a single, embedded metal object (usually a rebar stake) in opposite directions. By analyzing the data signature peaks caused by the rebar, one can assess the time lag and correct for it. This is done in an iterative fashion until the 2 peaks from opposite directions "line up". Figure A-4 presents example latency data prior to and after correction for System 1. The x axis plots Easting coordinates and the y axis plots signal amplitude. The correction for this dataset was 0.32 s or 320 milliseconds, which is typical for single coil system latency values.

DATA PROCESSING AND RESULTS

The EM data were processed in Geosoft's Oasis Montaj® software. Definitions of geophysical terms are given below followed by a list of the typical processing steps performed.

Definition of Terms

- *fiducial* - a single record/reading from the EM system consisting of 4 channels of data and time recorded.
- *linear interpolation* - The GPS recorded data at 1 reading per second and the EM systems recorded data at 5 readings per second. Therefore, GPS positions exist for every fifth EM reading; the others have no assigned coordinates. It is assumed that the operator traveled in a straight path between adjacent GPS readings. Linear interpolation assigns GPS coordinates to the EM readings that fall between 2 GPS positions based on the recording time.
- *sensor positioning* – The act of applying a position offset (in x and/or y directions) to the GPS recorded coordinate to correct for the fact that the GPS antenna is not positioned at the center of the EM coil sensor. This is used for the dual coil system because the antenna is mounted at the coils' right and left side for the left and right coils, respectively.
- *latency correction* – explained above in paragraph entitled "Latency Test"
- *demedian/median* – EM data from different systems recorded at different days will have inherently different baseline background values and potentially instrument drift throughout a given data profile. This is the nature of the EM instrument itself, primarily due to electronics. These data must be leveled so that all data collected throughout the project can be

meaningfully displayed with a single color profile. For example, a 20 mV anomaly from System 1 on Day 221 must be comparable to a 20 mV anomaly from System 2 on Day 223. The statistical median for a 200 fiducial long window centered about a given reading is calculated for every fiducial in an EM profile. This window "rolls along" a profile to calculate the median value for every fiducial (rolling statistics). The median value is then subtracted from the raw data to produce a profile that has no drift and a baseline value of 0. After this process has been applied, the data are termed "demedianed".

- *gridding* – The process of predicting EM amplitude values for areas over which data have not been collected based on the data that have been collected. This prediction is performed through a mathematical algorithm termed minimum curvature.

Standard Processing List

1. Linear interpolation between adjacent GPS points to assign latitude and longitude values to each EM reading. For the dual coil system, positioning is assigned for each coil. This is performed in Geomar's Multi61 MK2 software.
2. Export to Geosoft xyz file and import into Oasis Montaj® database.
3. Projection from WGS 1984 Geographic Coordinate System to NAD27 California State Plane Zone 3 Projected Coordinate System.
4. Latency correction.
5. Manual masking/deletion of fiducials with poor quality GPS data as evident in survey transects.
6. Median calculation for Channels 2 and 3 with 200 fiducial rolling statistics. Demedian of Channel 2 and 3 raw data.
7. Gridding of Channel 2 raw and demedian data using minimum curvature algorithm with 0.5 ft cell resolution and 1.65 ft blanking distance. The gridded data were blanked to plot data only within the EM coil spatial extents.
8. Export to GeoTiff format for display in ArcGIS and metadata creation.

Data from 16 separate days of collection were processed to produce a final anomaly map. The data cover an area of approximately 24 acres. This coverage area is defined as the area collected along a 1 meter wide path for each coil transect. A single grid (master map) for the entire site was produced in Oasis Montaj by gridding all the data collected for the entire project. The final dataset was submitted to Battelle via e-mail and labeled "Grid 11". This grid is complete through October 7, 2004 (end of field operations) and the data are from Channel 2, demedianed, using a rolling window of 200 fiducials. The resultant map is presented in Figure B-1 (Appendix B). Figure B-1 shows black outlined polygons for areas of suspected waste disposal areas provided by Battelle on the basis of available historical site documentation. The Channel 2 raw data are presented in Figure B-2 so that comparison with Figure B-1 can be performed. The roads layer is also shown in both figures to aid in interpretation. The roads locations depicted on this layer are based on historical site information, as provided by Battelle. These roads do not necessarily currently exist in their depicted locations, if at all.

The data presented in Figures B-1 and B-2 have assigned color values ranging from –10 to 500 mV. The statistics for the raw data from channel 2 are presented in Table 2 below and all values are in units of mV:

Table 2 – Channel 2 Statistical Summary

	Channel 2 Raw	Channel 2 Demedianed
Number of items	1,323,888	1,323,888
Minimum value	-4,592.12	-5,197.37
Maximum value	15,430.41	14,818.95
Mean value	424.18	160.83
Standard deviation	809.00	743.26

EM amplitudes can sometimes be used to quantitatively discern between anomaly size, depth, or orientation, when readings are below nominally 200 mV. This type of analysis is sometimes performed on UXO targets in low background noise environments. Amplitude readings beyond 400 or 500 mV simply indicate that large, shallow metallic objects are present or that the soil is metal-laden (scrap or other debris). The color scale of –10 to 500 mV was chosen to show the extent of such significant anomalies in bright orange, for ease of visual interpretation. Figure B-3 presents the raw channel 2 data rescaled from 0 to 2000 mV to allow for discrimination of higher amplitude levels.

Data Interpretation

Data were collected along perpendicular lines nominally spaced at 50 ft in the Landfill area and along unidirectional parallel lines nominally spaced at 25 ft in the Wetlands area. The Wetlands were characterized by low background noise levels (near 0 mV) and few anomalies, i.e., the Wetlands data were relatively clean. One anomaly, at the far southwest corner of the Wetlands area, may potentially represent buried or surface metallic debris. The potential dredge material that historical information suggests may have been disposed in the Wetlands did not produce anomalous voltage readings as recorded by the EM61 MKII.

In general, the data in the Landfill were characterized by significant cultural noise due to the metallic surface debris and buried waste objects. Voltage readings of 200-300+ mV may indicate large metallic objects buried at shallow depths or metallic debris directly on the surface. Anomaly modeling of data with such high amplitudes may produce erroneous predicted depth and erroneous sizes. The predicted depths are often above the surface or deeper than the maximum EM sensor influence depth of 3+ m (refer to page 1 of *EM 61-MK2 4 Channel High Sensitivity Metal Detector Operating* Manual, Geonics Limited, 2001). The roadway paths were relatively quiet. This may indicate that these roads were cleared of debris by a bulldozer or the landfill material was never dumped along these roads. Because of the high background noise content, individual anomaly delineation of the suspected potential buried waste areas was not possible. However, larger, regional anomalies were apparent and Battelle selected these areas for full coverage data collection (Figure B-1). The full coverage collection further defined the spatial extents of these anomalies. Figure B-1 shows an area of no coverage west of the western bunker and another area southeast of the South Pond in the Wetlands area. These areas were not collectable because of thick vegetation which prohibited instrument/operator entry and blocked GPS satellite signal.

The suspected oil pit area near the western Landfill edge and suspected chemical drum area near the eastern Landfill edge at mid-latitude are anomaly free. The other suspected areas all enclose high grid values. The high grid values cover much of the site and therefore distinct anomaly delineation is not possible. Figure B-3 can be examined for low values to determine where anomalies are absent. Orange-colored grid regions in Figure B-3 may indicate large metallic objects buried at relatively shallow depths.

Proposed Sampling Locations and Sensitivity Analysis

After review of Grid 10, Battelle proposed 100 coordinate locations for investigative sampling. Power reviewed these locations to ensure lowest risk of intersecting any buried metallic items. This was a deviation from the initial plan that Power would generate a target list for Battelle to use in choosing sampling locations. This approach was taken because of the extensive areas of anomalous data for which individual target recognition was not possible.

In order to ensure lowest risk of intersection, a sensitivity analysis was performed. First, all proposed locations were inspected to ensure that they lay within the grid boundaries, i.e., at a ground position over which an EM61 MKII coil passed. This analysis proved that the 100 proposed samples were all located within grid boundaries. Secondly, the data values for both the Grid 10 raw and Grid 10 demedianed data were extracted for each proposed sample location. This automated process resulted in 2 grid values for each location. For those locations for which the absolute values for both grids were less than 8 mV, the locations were automatically approved for sampling. These samples were primarily in the Wetlands area. For the Landfill area, a more thorough sensitivity analysis was performed. For each value, the raw data profile was inspected. The sample locations were moved to local grid value minimums, typically within 8 feet of the originally proposed locations. These new grid value minimums were as high as near 500 mV and were anticipated to be locations where risk of intersecting buried metallic objects was minimal. This type of analysis was the only logical way to promote safe drilling, considering the high background EM levels and requirement to move proposed locations as short of a distance as possible. 59 of the locations were approved at their proposed coordinates and 41 of the locations were moved to local grid minimums. The results of the sensitivity analysis and new approved coordinates for the moved sampling locations are presented in Tables C-1 and C-2 of Appendix C, respectively.

The enclosed DVD includes field notes (including sketch map of surveyed areas), standardization documentation (QC result forms), downloaded raw data in machine (*.N61) and xyz format, processed data in xyz format, and zipped GeoTiff images for Grids 1 through 11 of Channel 2 demedianed data and for Grid 11 Channel 2 raw data. The color scale for the GeoTiff images is the same as that shown in Figures B-1 and B-2 of Appendix B (-10 to 500 mV) and the images are described with metadata. Grids 11 (demedianed data) and 11r (raw data) are also included as ArcView float (*.flt) format so that the recorded EM amplitude values can be viewed and a different color scale can be applied to the data. The transect lines for the entire site are included as an ArcView shape file. The verification status of the proposed sampling locations and new coordinates for moved locations are included as Excel csv files. Digital photos taken at the site are included in the DVD and presented in Appendix D. All final x,y coordinates are in the NAD 27 California State Plane Zone 3 projected coordinate system and the EM amplitude values are in units of millivolts (mV).

CONCLUSIONS

The EM data were successful in identifying the presence and extent of large scale anomalies that may represent buried waste features. Despite the high background noise levels in the Landfill, the EM data identified larger regional anomalies. The anomalies in the Landfill area are characterized by heavy metal content in the first 1 to 1.5 m of the subsurface. The Wetlands area and northeast site corner were essentially anomaly free. Please contact us with any questions you may have regarding the results of this letter report.

Sincerely,

David A. Hollema
Project Geophysicist

Matthew Benson
Project Manager

Appendix A – Example QC Data

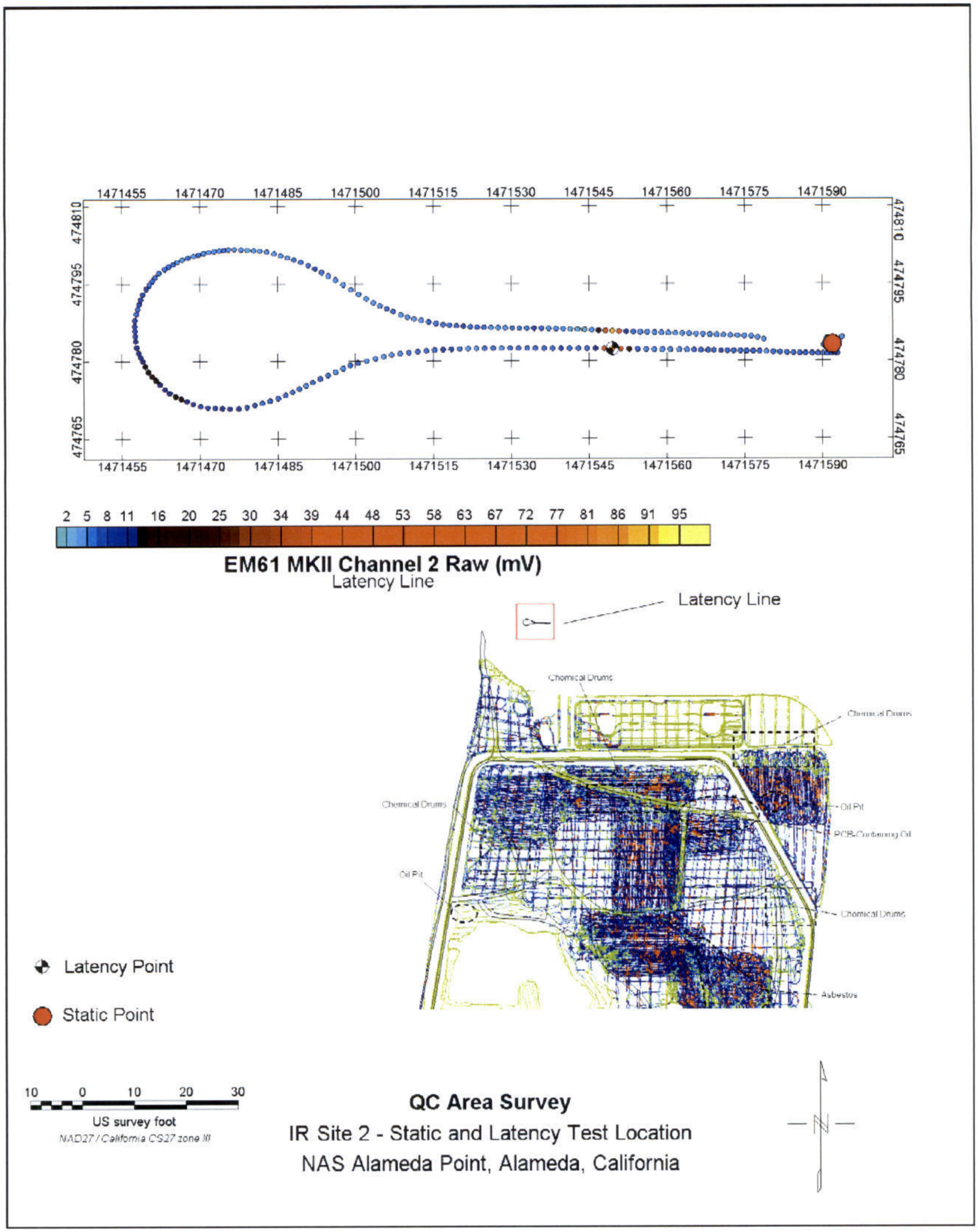

Figure A-1 Latency and Static Point Locations

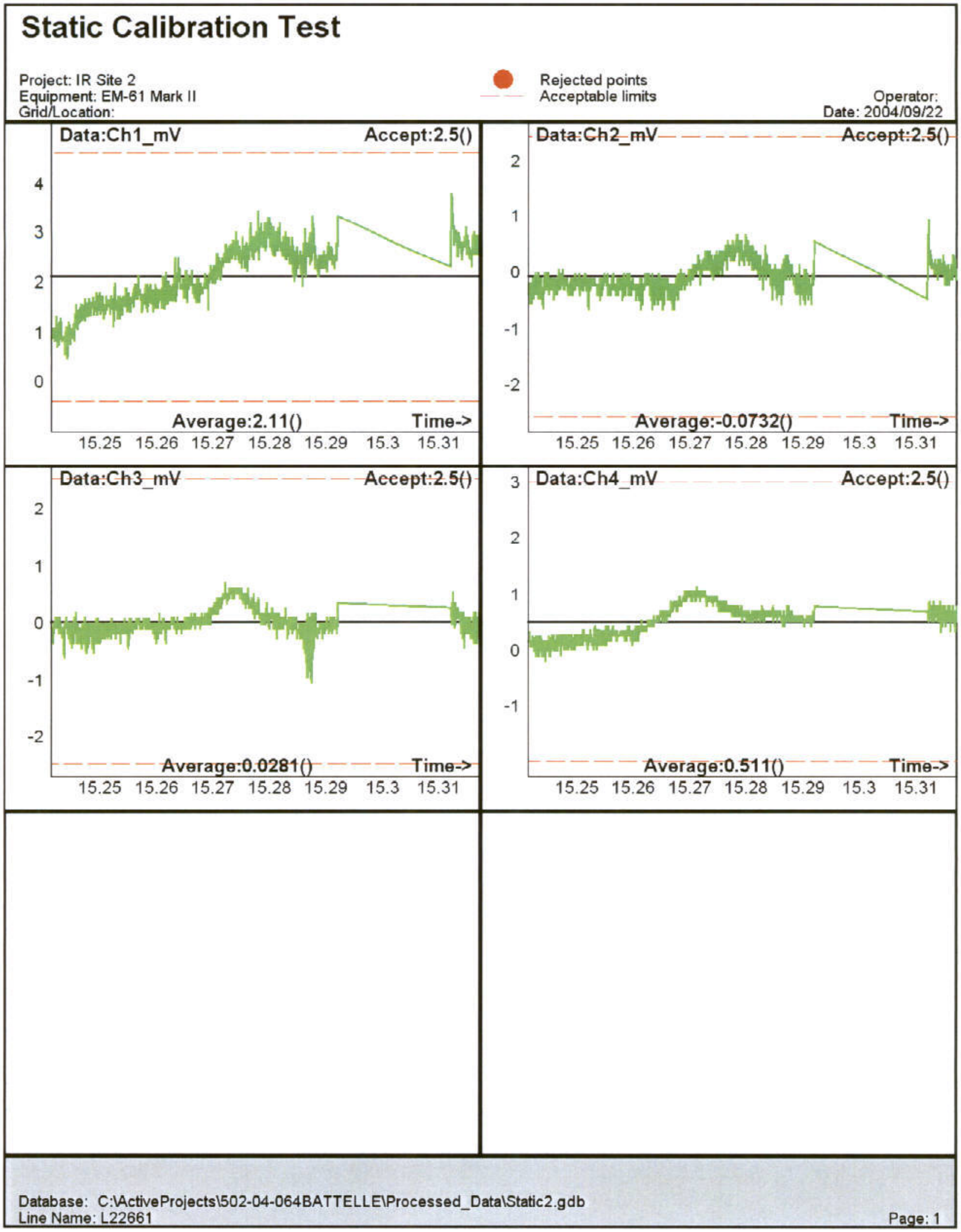

Figure A-2 – Example Static Background Response Test Results for System 2 on September 22

Channel:	Ch1_mV			
Line	Number	Minimum	Maximum	Mean
ALL	321.36	349.54	332.82	337.21
L22661S:0	333.22	349.54	337.98	337.98
L22662S:0	321.36	342.62	326.6	326.68
Channel:	Ch2_mV			
Line	Number	Minimum	Maximum	Mean
ALL	223.05	237.66	228.84	230.05
L22661S:0	227.01	237.64	230.45	230.55
L22662S:0	223.05	237.66	226.92	226.7
Channel:	Ch3_mV			
Line	Number	Minimum	Maximum	Mean
ALL	131.21	140.23	134.26	134.4
L22661S:0	131.21	140	134.21	134.32
L22662S:0	132.66	140.23	134.33	134.24
Channel:	Ch4_mV			
Line	Number	Minimum	Maximum	Mean
ALL	63.8	67.74	65.62	65.69
L22661S:0	63.8	66.91	65.7	65.81
L22662S:0	64.93	67.74	65.52	65.46

Figure A-3 – Example Static Standard Response Test Results for System 2 on September 22

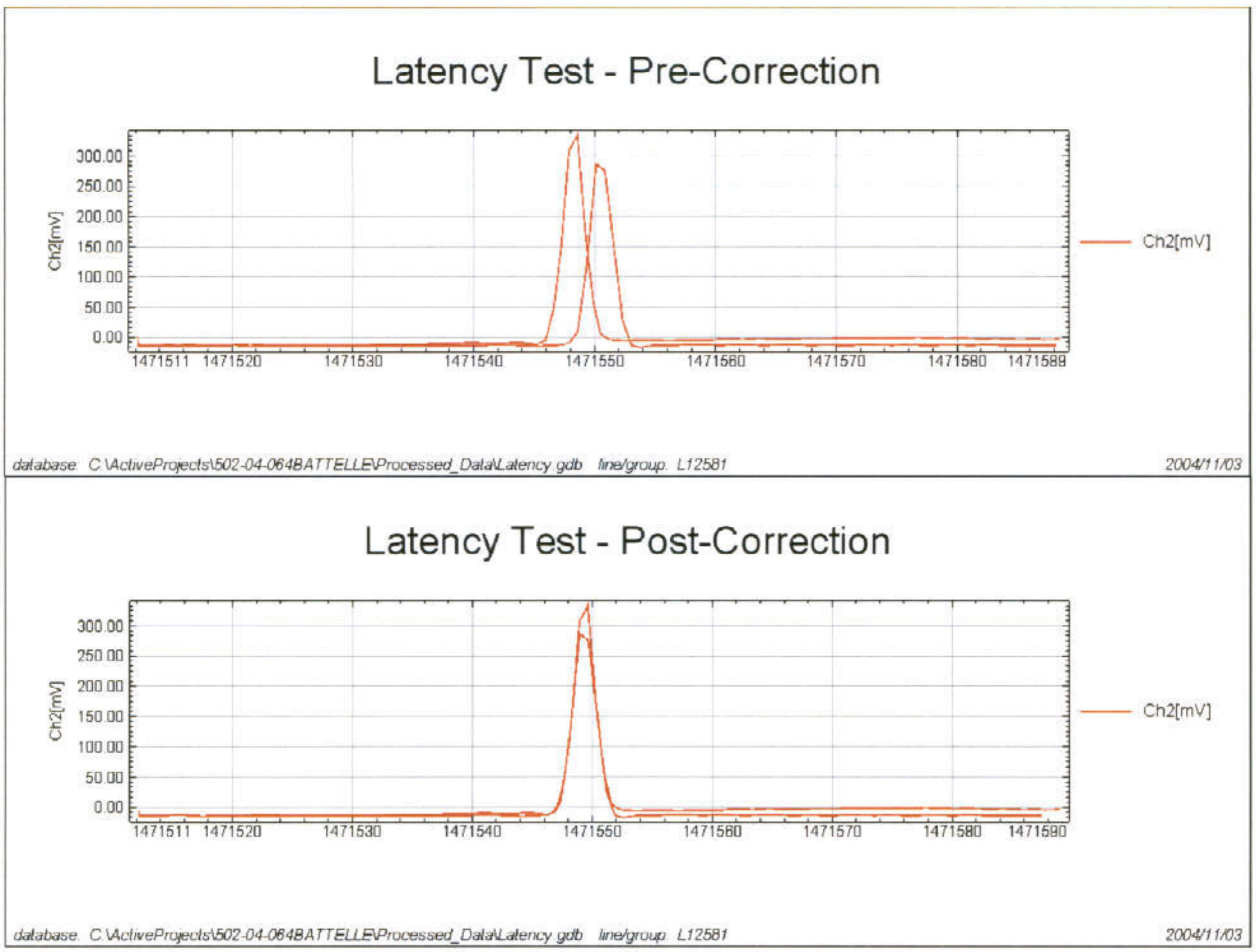

Figure A-4 – Example Latency Correction Results for System 1

Appendix B – Final Maps

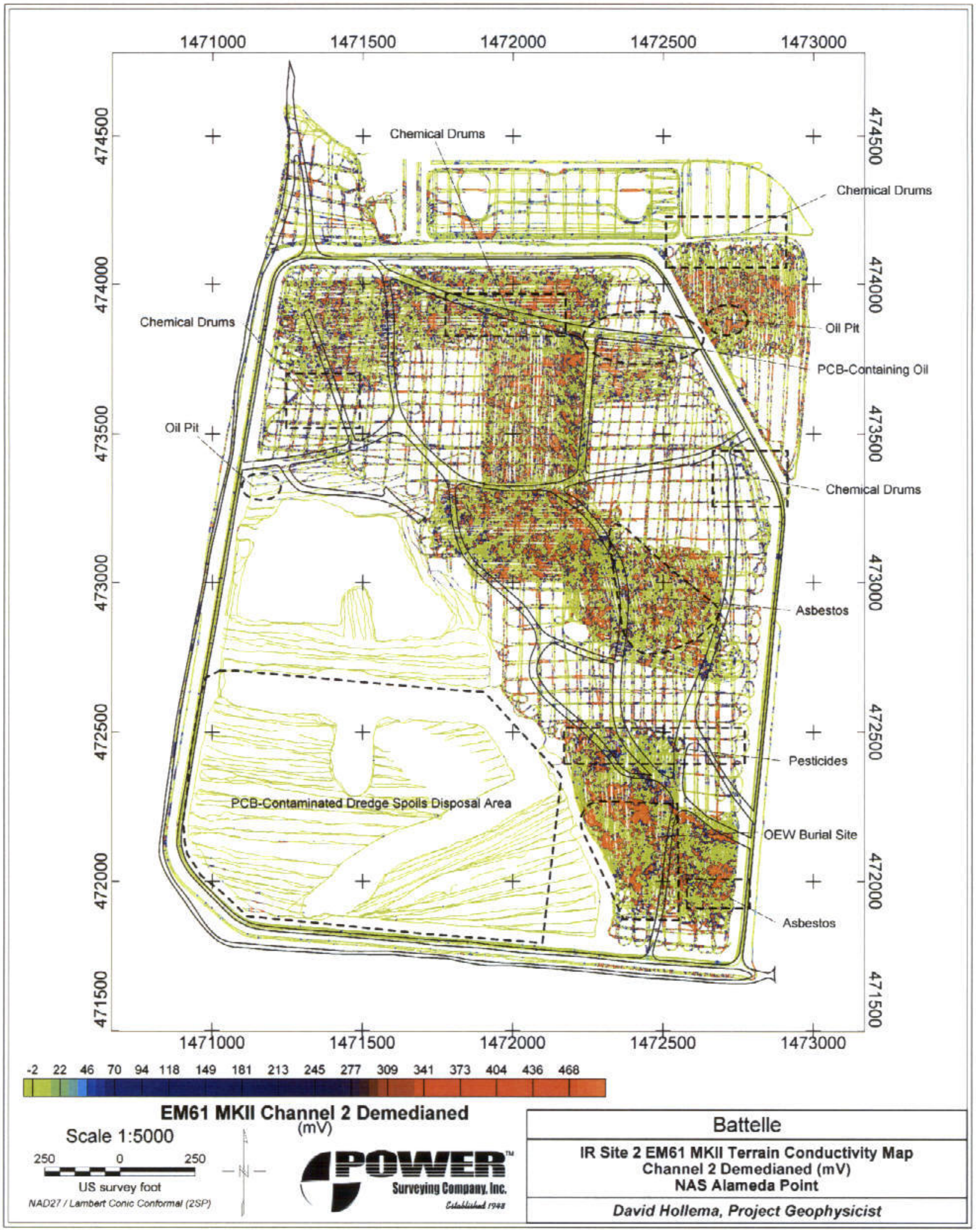

Figure B-1 – Final Electromagnetic Geophysical Map for IR Site 2 (Demedianed Data)

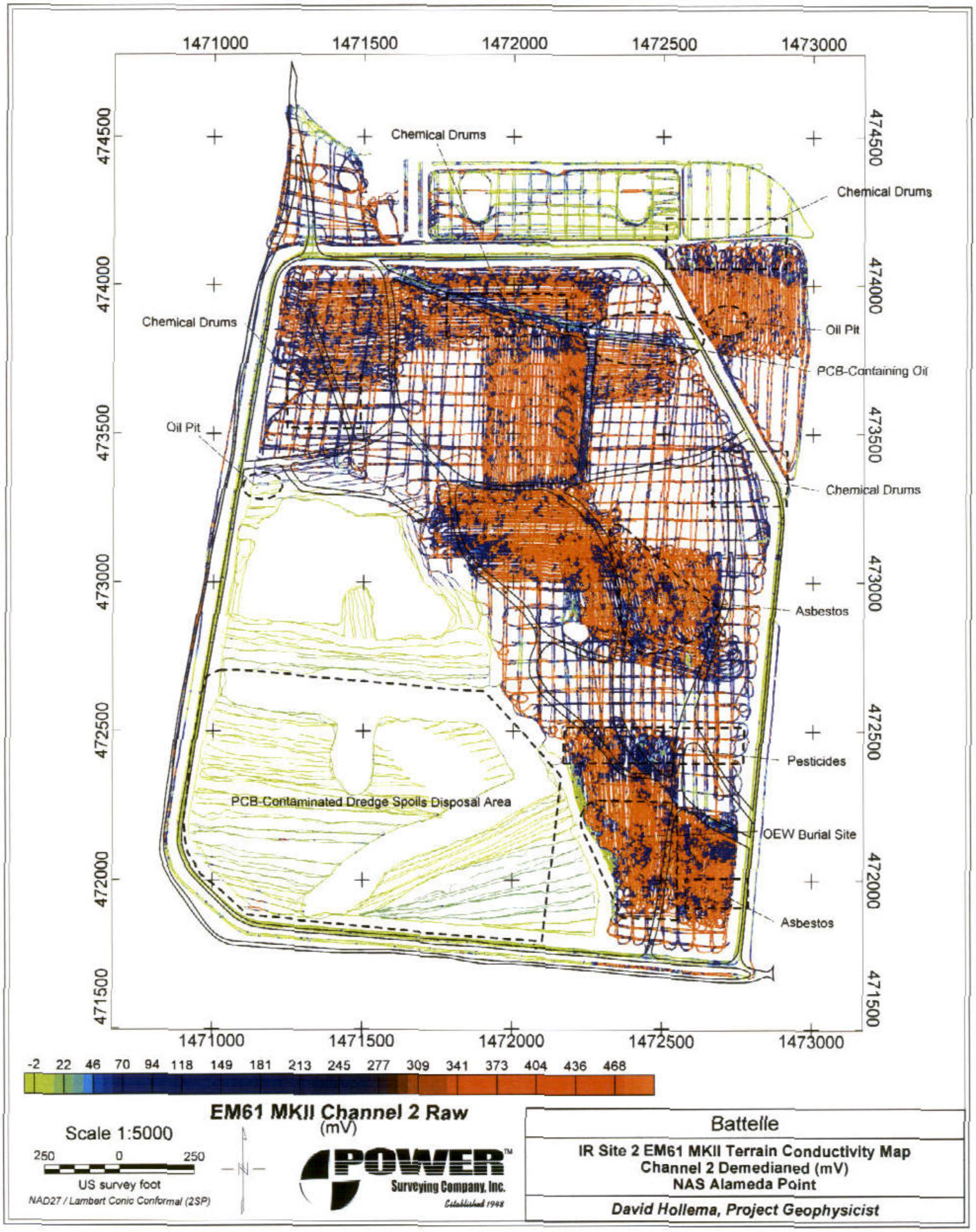

Figure B-2 – Final Electromagnetic Geophysical Map for IR Site 2 (Raw Data)

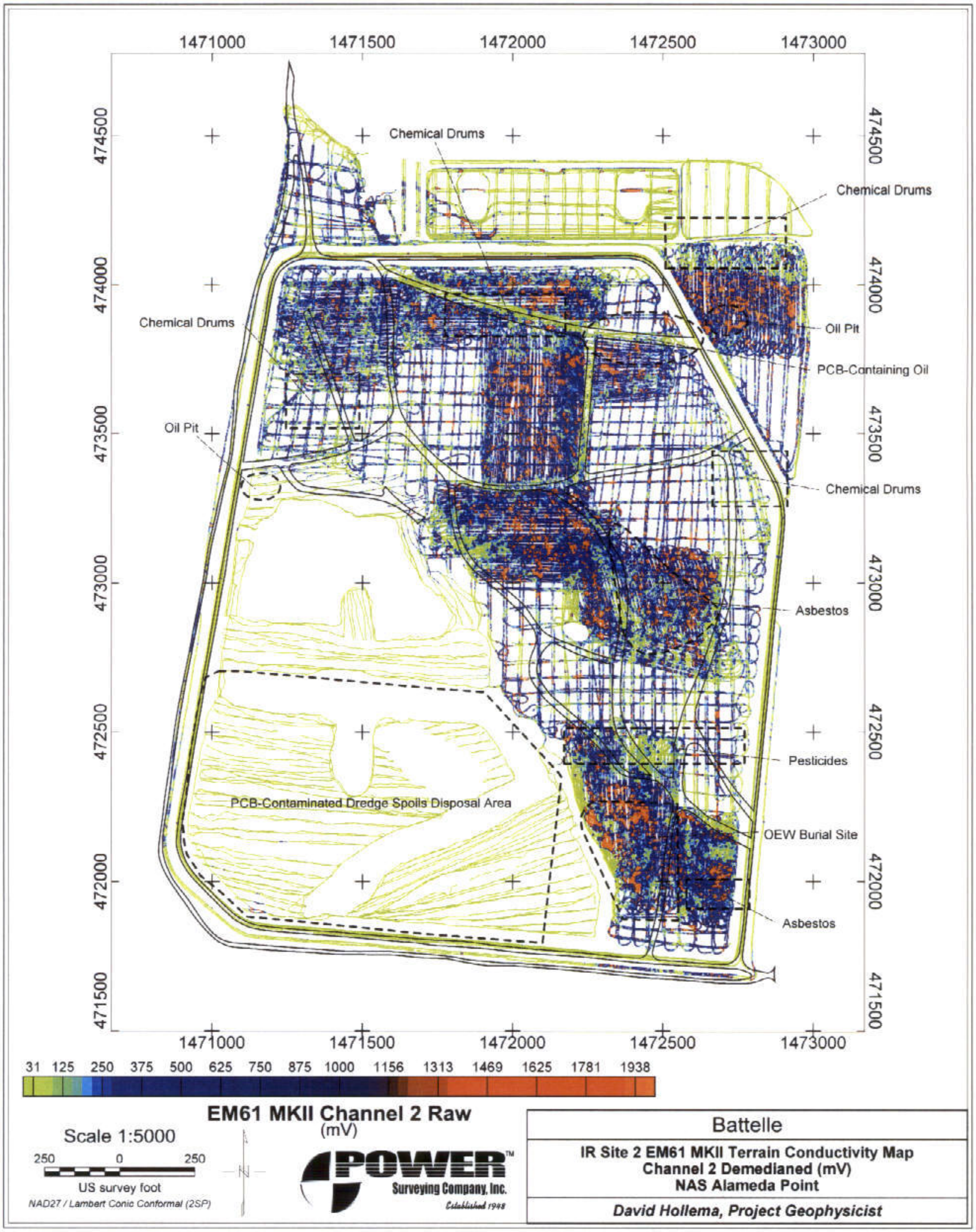

Figure B-3 – Final Electromagnetic Geophysical Map for IR Site 2 (Raw Data Rescaled)

Appendix C – Approved Sampling Locations

Table C-1 – Proposed Sampling Location Results

SAMPID	X	Y	ID1	OBJECTID	Grid_10_DMD_Value	Grid_10_RAW_Value	Verification
HYP01	1471494.5	474366.7	88	8	-16.41	83.15	Moved
HYP02	1472643.2	474056.7	89	9	-139.62	160.49	Approved
HYP03	1472680.2	473867.8	98	18	-195.14	284.17	Moved
HYP04	1471375.2	473891.9	99	19	-103.86	120.41	Moved
HYP05	1471904.6	473936.4	90	10	-43.33	80.50	Moved
HYP06	1472369.7	473781.3	91	11	-124.92	285.23	Moved
HYP07	1471597.6	473738.9	100	20	-206.07	123.59	Moved
HYP08	1471332.2	473588.5	92	12	-101.78	175.49	Approved
HYP09	1471716.7	473344.5	93	13	-58.87	176.19	Moved
HYP10	1472709.4	473346.7	95	15	-74.46	86.87	Moved
HYP11	1472385.5	473088.1	94	14	-138.75	231.01	Approved
HYP12	1472547.6	472476.9	96	16	-49.58	115.41	Moved
HYP13	1472659.4	471937.7	97	17	-171.41	254.25	Moved
HYP14	1471200.1	473328.9	82	2	-18.49	5.66	Approved
HYP15	1471255.2	472782.6	81	1	-0.26	12.00	Approved
HYP16	1471940.8	472779.5	83	3	-263.89	37.32	Moved
HYP17	1471092.6	472352.3	86	6	0.21	-5.67	Approved
HYP18	1471823.0	472487.5	87	7	-0.68	5.30	Approved
HYP19	1471111.8	471938.6	85	5	-8.70	4.59	Approved
HYP20	1472049.2	471907.1	84	4	-0.04	25.61	Approved
SOC01	1471494.5	474366.7	76	36	-16.41	83.15	Moved
SOC02	1471584.0	474304.9	41	1	-48.63	150.09	Moved
SOC03	1471793.1	474169.5	50	10	-7.59	42.45	Moved
SOC04	1472412.7	474165.5	42	2	0.10	1.46	Approved
SOC05	1472758.3	474166.6	43	3	-10.68	9.47	Approved
SOC06	1472643.2	474056.7	44	4	-139.62	160.49	Approved
SOC07	1472680.2	473867.8	73	33	-195.14	284.17	Moved
SOC08	1472886.3	473769.0	45	5	-217.79	161.91	Moved
SOC09	1472813.7	473531.1	61	21	-225.98	150.76	Moved
SOC10	1471375.2	473891.9	74	34	-103.86	120.41	Moved
SOC11	1471904.6	473936.4	48	8	-43.33	80.50	Moved
SOC12	1472134.1	473895.5	47	7	-53.80	119.60	Moved
SOC13	1472369.7	473781.3	49	9	-124.92	285.23	Moved
SOC14	1471297.9	473746.5	51	11	-29.10	114.01	Moved
SOC15	1471597.6	473738.9	77	37	-206.07	123.59	Moved
SOC16	1471925.1	473689.0	56	16	-177.41	277.39	Moved
SOC17	1471332.2	473588.5	52	12	-101.78	175.49	Approved
SOC18	1471655.5	473494.6	78	38	-91.06	57.61	Approved
SOC19	1472096.3	473510.1	55	15	-225.05	500.88	Moved
SOC20	1472405.9	473538.7	46	6	-100.45	165.17	Approved
SOC21	1471299.9	473379.2	53	13	-51.50	125.21	Moved

SAMPID	X	Y	ID1	OBJECTID	Grid_10_DMD_Value	Grid_10_RAW_Value	Verification
SOC22	1471716.7	473344.5	54	14	-58.87	176.19	Moved
SOC23	1472230.3	473352.4	75	35	-71.81	176.83	Moved
SOC24	1472709.4	473346.7	63	23	-74.46	86.87	Moved
SOC25	1471961.4	473192.3	58	18	-294.52	133.67	Moved
SOC26	1472504.4	473216.9	59	19	-223.29	348.19	Moved
SOC27	1472385.5	473088.1	60	20	-138.75	231.01	Approved
SOC28	1472732.8	473036.8	64	24	-103.21	86.02	Approved
SOC29	1471876.7	473012.3	57	17	-442.95	58.46	Approved
SOC30	1472205.2	473005.2	66	26	-207.03	76.31	Approved
SOC31	1472501.1	472869.8	62	22	-206.93	151.25	Moved
SOC32	1472095.0	472680.9	67	27	-230.86	139.10	Moved
SOC33	1472437.0	472685.4	79	39	-183.29	113.96	Approved
SOC34	1472686.3	472669.5	65	25	-70.20	60.32	Moved
SOC35	1472253.3	472410.2	68	28	-126.09	186.67	Approved
SOC36	1472547.6	472476.9	70	30	-49.58	115.41	Moved
SOC37	1472533.7	472219.7	69	29	-197.11	125.55	Approved
SOC38	1472327.7	472174.1	80	40	-488.52	75.26	Moved
SOC39	1472454.4	471974.7	72	32	-200.82	161.83	Approved
SOC40	1472659.4	471937.7	71	31	-171.41	254.25	Moved
SOC41	1471200.1	473328.9	27	27	-18.49	5.66	Approved
SOC42	1471597.4	473262.1	28	28	-1.65	119.56	Approved
SOC43	1471716.0	473047.7	29	29	-44.96	101.97	Moved
SOC44	1471940.8	472779.5	30	30	-263.89	37.32	Moved
SOC45	1471627.0	472726.5	40	40	-0.45	14.20	Approved
SOC46	1471255.2	472782.6	26	26	-0.26	12.00	Approved
SOC47	1471092.6	472352.3	36	36	0.21	-5.67	Approved
SOC48	1471195.5	472134.5	37	37	-0.56	20.61	Approved
SOC49	1471697.5	472281.5	38	38	-0.40	5.07	Approved
SOC50	1471823.0	472487.5	39	39	-0.68	5.30	Approved
SOC51	1471111.8	471938.6	35	35	-8.70	4.59	Approved
SOC52	1471732.1	471959.0	34	34	-0.41	23.48	Approved
SOC53	1472049.2	471907.1	33	33	-0.04	25.61	Approved
SOC54	1472036.5	472115.3	32	32	0.41	5.91	Approved
SOC55	1472106.8	472492.9	31	31	-50.36	142.94	Moved
SOG01	1471147.7	473214.5	12	12	0.24	-2.39	Approved
SOG02	1471360.1	473314.4	13	13	-6.91	4.71	Approved
SOG03	1471657.7	473155.7	14	14	-55.30	60.25	Moved
SOG04	1471872.2	472936.1	15	15	-57.00	1.38	Approved
SOG05	1471836.9	472732.0	16	16	-0.47	13.24	Approved
SOG06	1471473.1	472708.3	18	18	0.31	17.17	Approved
SOG07	1471466.5	472889.2	17	17	-0.07	-0.77	Approved
SOG08	1471305.6	472819.7	19	19	0.65	3.59	Approved
SOG09	1471095.2	472770.5	10	10	-0.37	13.45	Approved

SAMPID	X	Y	ID1	OBJECTID	Grid_10_DMD_Value	Grid_10_RAW_Value	Verification
SOG10	1471094.0	472993.8	11	11	-0.44	-2.68	Approved
SOG11	1471039.8	472510.7	9	9	-0.05	-3.76	Approved
SOG12	1471356.9	472519.0	7	7	-0.21	-1.75	Approved
SOG13	1471225.0	472446.3	8	8	-0.28	-4.06	Approved
SOG14	1471189.8	472270.9	20	20	0.04	-2.24	Approved
SOG15	1471042.2	472181.3	1	1	-0.04	16.08	Approved
SOG16	1471358.0	472198.4	2	2	0.06	14.38	Approved
SOG17	1471341.6	472060.3	3	3	-0.08	19.35	Approved
SOG18	1471504.9	472192.4	4	4	0.00	14.65	Approved
SOG19	1471626.6	472338.3	5	5	-0.21	5.88	Approved
SOG20	1471602.1	472532.0	6	6	0.06	7.58	Approved
SOG21	1471893.0	472398.9	25	25	1.32	6.21	Approved
SOG22	1471568.2	471906.6	21	21	-0.13	20.40	Approved
SOG23	1471889.2	472020.7	23	23	0.20	25.28	Approved
SOG24	1472048.8	472026.0	24	24	-0.18	26.71	Approved
SOG25	1471896.2	471870.5	22	22	-0.14	27.42	Approved

Continue

Table C-2 – New Approved Coordinates for Moved Sampling Locations

SAMPID	X	Y	Ch2_mV
HYP01	1471494.8	474364.2	55.26
HYP03	1472679.9	473870.2	167.41
HYP04	1471374.7	473894.6	79.7
HYP05	1471899.1	473936.1	53.45
HYP06	1472372.8	473781.3	213.89
HYP07	1471599.0	473736.4	111.96
HYP09	1471717.1	473344.3	177.59
HYP10	1472708.7	473347.7	84.4
HYP12	1472546.7	472476.3	108.61
HYP13	1472660.4	471934.8	195.68
HYP16	1471937.0	472787.4	0.71
SOC01	1471494.8	474364.2	55.26
SOC02	1471580.7	474304.5	115.19
SOC03	1471796.2	474169.1	28.62
SOC07	1472679.9	473870.2	167.41
SOC08	1472887.4	473769.9	107.47
SOC09	1472814.0	473529.4	126.88
SOC10	1471374.7	473894.6	79.7
SOC11	1471899.1	473936.1	53.45
SOC12	1472134.0	473886.3	23.58
SOC13	1472372.8	473781.3	213.89
SOC14	1471300.3	473746.8	124.88
SOC15	1471599.0	473736.4	111.96
SOC16	1471924.6	473681.6	114.44
SOC19	1472095.8	473511.8	330.27
SOC21	1471300.7	473379.0	114.22
SOC22	1471717.1	473344.3	177.59
SOC23	1472230.6	473350.6	137.7
SOC24	1472708.7	473347.7	84.4
SOC25	1471959.7	473193.4	98.34
SOC26	1472497.6	473217.9	179.39
SOC31	1472499.7	472871.5	85.25
SOC32	1472095.1	472680.0	129.5
SOC34	1472687.6	472668.2	56.89
SOC36	1472546.7	472476.3	108.61
SOC38	1472326.4	472176.9	62.22
SOC40	1472660.4	471934.8	195.68
SOC43	1471715.1	473047.5	62.7
SOC44	1471937.0	472787.4	0.71
SOC55	1472106.9	472492.7	130.26
SOG03	1471660.7	473147.8	24.06